INDUSTRIAL ARTS
FOR
ELEMENTARY SCHOOLS

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INDUSTRIAL ARTS
FOR
ELEMENTARY SCHOOLS

BY

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To

JAMES E. RUSSELL

AT THE CLOSE OF HIS TWENTY-
FIFTH YEAR AS DEAN OF
TEACHERS COLLEGE

PREFACE

PART I of this book is presented as a brief exposition of the principles for the organization and teaching of the industrial arts in elementary schools. Part II is an application of these principles to the activities in which the children may engage, together with much related subject matter. For each grade, the principal desired outcomes are specifically stated. Chapter Thirteen is an historical chapter, reviewing the forms by which attempts have been made to introduce the use of concrete materials into the work of the elementary schools in America.

It will be noted that all of the work in the six large fields presented in Part II is stated in the form of activities. Every unit of work to be experienced is presented as something to be done. Some of these activities are constructive, some are investigative, and some are appreciative — all involve participation. In most of those listed, more than one kind of activity is required. Constructive work is presented as a means of awakening intellectual inquiries, of giving meanings and values, of cultivating appreciations, and of leading on to further interests on levels higher than those apparent at the beginning of the constructions. Selections of work of all kinds are often deliberately made to stimulate an inquiring attitude of mind, to arouse a desire to find meanings and values, and to open up lines of interest and possibility for continued and permanent mental growth by thinking, aided by observation, experimentation, and reading. The impulses of children to investigate and to enjoy, or appreciate, have been utilized quite as much as the impulses to manipulate and construct. Developing ability to carry investigations to successful conclusions is quite as prominent as an aim as acquiring useful information and cultivating desirable attitudes.

The book is designed for teachers and students preparing to teach in the elementary schools. The work may easily be adapted to the conditions of rural schools as well as to various types of village and city schools. It is assumed that the study of the industries is entitled to a place as a regular subject in the elementary school, to be taught by the regular teacher. While prepared for the teachers, it contains much that may be used by the children themselves. The illustrations have been carefully selected to be as much a teaching part of the book as its textual content.

The authors have said little about the values of the work in the formation of character or of any other broadly general human qualities by which the larger worth of life is measured. But they have profound faith that if the meanings for the enrichment of life in the studies are dwelt upon throughout as they should be, the work will have very significant influence in making for genuine culture and character. In stating outcomes, the endeavor has been to keep within the bounds of tangible, traceable results. Nevertheless, it is believed that all of these specific outcomes contribute to the development of an outlook upon man and upon life that is humane, just, progressive, and righteous.

To Dean James E. Russell of Teachers College, Columbia University, the authors are indebted for much of the underlying philosophy of the book, and for the opportunity to develop the work in practice in the Schools of Teachers College through the past twelve years. To him they grate-fully express their obligation and their appreciation of his inspiration.

Colleagues and many others who cannot be named because of their number have contributed much in the development and presentation of the book. To all of these the authors wish to express their sense of indebtedness and appreciation.

Frederick G. Bonser
Lois Coffey Mossman

New York,
March, 1923

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PART I

PRINCIPLES OF SELECTION AND ORGANIZATION

INDUSTRIAL ARTS FOR ELEMENTARY SCHOOLS

CHAPTER I

THE MEANING AND PURPOSES OF INDUSTRIAL ARTS

What we mean by industrial arts. Few of the materials which we use are used just as nature produces them. We change the form of the trees of the forest into lumber, then into furniture, parts of buildings, and other products of wood. We change wheat and corn by milling and cooking processes into foods more palatable and wholesome than these grains are as produced by nature. We take the crude iron ore as it comes from the mines and through various changes make it into final forms serving uses so numerous that we sometimes speak of this as the iron age. We change masses of native clays into jars, jugs, vases, and china, both useful and beautiful. We take numerous fibers produced by nature, and through many changes in their form we furnish ourselves with garments suited to every purpose of climate or occasion. All of these changes which we make in the forms of materials, that they may be more useful, we call *industrial* changes. We speak collectively of the occupations devoted to the making of these changes as *industries*, or *industrial arts*. The general term *manufactures* means about the same thing, but industrial arts is preferable as it is more inclusive.

Industrial arts as distinguished from agriculture, mining, and transportation. Agriculture and mining are occupations devoted to the production of raw materials. Hunting and fishing are also occupations concerned with the securing of certain animal materials used by man. These occupations provide us with the natural materials themselves, but they make no changes in their form. The industrial arts have to do with the desirable changes made in the forms of these materials after they are procured. Changing the location of materials and products from place to place by transportation is not a matter of industrial art but of industrial exchange and commercial geography. We often speak of these changes in location and ownership collectively as transportation and trade. To fix some reasonable limit in our use of the term, industrial arts, we include those occupations only which have to do with the *changes in the form* of materials, and exclude those occupations having to do with procuring raw materials and transporting them and their products.

Industrial arts as distinguished from fine arts. Man seems to have a universal tendency to beautify all of the materials which he transforms for his use. He also develops a strong tendency to make things purely for the sake of their beauty, quite apart from any use other than that of decoration or of the feeling of satisfaction which they give. He makes products in form and color which express conceptions and feelings of beauty, such as paintings, sculptures, and other ornamental or decorative forms. The activities by which these forms of beauty are expressed and produced are called *fine arts.*

Since the desire for beauty in all that we possess or produce is so fundamental, it is readily seen that the industrial arts and the fine arts are closely and vitally related. Any attempt to separate them completely is artificial. For the sake of emphasis, we may say that the industrial arts are concerned with the *use* of material products, the fine arts with their *beauty*. In the process of their design and production, however, the two purposes are almost inseparably related. While the fine arts have fields quite outside of and apart from the industrial arts in such forms as painting and sculpture, their largest field lies in the refining and beautifying of the material products which we fashion to meet the useful purposes of everyday life. In the study of the industrial arts it is therefore very essential to include all of those phases of the fine arts which have to do with beautifying the products of industry. In all problems of design, decoration, and use of industrial products, the fine arts element is included as an integral part of their appropriate development.

Definition of industrial arts. The foregoing paragraphs may now be summarized by defining the industrial arts in this way: *The industrial arts are those occupations by which changes are made in the forms of materials to increase their values for human usage.* As a subject for educative purposes, *industrial arts is a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes.*

The purposes of studying the industrial arts. There are two kinds of study of the industrial arts, each having its own distinctive purpose, the vocational and the general educative purpose.

The vocational purpose. The processes of an industry may be studied for the sake of developing skill and efficiency in producing in this particular industry. This kind of study we call *vocational*. When we use the term *industrial education*, we mean a definite, intensive training for productive work in some industry, as that of the pattern maker, or machinist, or carpenter, or tailor, or plumber, or potter, or tinner, or printer, or automobile mechanic, or factory worker. Industrial education applies to industrial workers as agricultural education applies to farmers, commercial education to stenographers, bookkeepers, and other commercial employees, medical education to physicians, or legal education to lawyers. The vocational study of an industry includes provision for gaining both a knowledge of its processes and sufficient practice in their execution to develop skillful and efficient production. Its fundamental and controlling purpose is to develop efficient workers. It is highly specialized and intensive. To develop the efficiency required, one may have to devote from three or four to eight hours a day to practice in its processes for several years. Clearly, such work has no place in the elementary school nor in the early years of the junior high school.

The general educational purpose. The materials, processes, conditions of production, and the purchase and use of the products of the more important industries may be studied for the values which such study affords in one's everyday life, regardless of his occupation. Such a study of the industrial arts we describe as general. To realize its purposes we make no attempt to develop any considerable degree of skill in any of the several industries studied. Productive skill is not included in its purposes as it is in vocational education. The field includes numerous industries, not limiting itself to one industry as in vocational education.

The purposes or outcomes of the general study are realized in the degree in which it helps one to become efficient in the selection, care, and use of the products of industry, and to become intelligent and humane in the regulation or control of industrial production. This study is from the point of view of the problems, opportunities, and obligations of the consumer and the citizen. It concerns itself with such common, daily needs of life as the selection and use of food, clothing, utensils, household furnishings, and other products of industry; and to such problems of citizenship as call upon us to share in the regulation of industry, so that all employees, employers, and citizens may receive just and fair treatment.

Specific values and objectives in industrial arts. There are five different, though closely related, kinds of value to be derived from the study of the industrial arts which help very fundamentally to guide us in the selection of problems and materials for study. There are also a number of other objectives to be emphasized here and there, but these are realized largely as incidental by-products in the achievement of the five purposes here indicated as dominant. These five objectives may be stated as (1) a health purpose; (2) an economic purpose; (3) an art or æsthetic purpose; (4) a social purpose; and (5) a recreational purpose. A brief description of each follows.

1. *The health purpose.* In selecting and using foods, our health is the factor of most importance. If we do not get the proper amount and proportion of sugars or starches, proteins, fats, minerals, and vitamines, we are not properly nourished. An inappropriate diet is one of the most common causes of poor health. Our study of the food industries in relationship to health should help us very materially to keep well.

Clothing also affects health. Poorly fitting shoes alone cause much suffering and ill health. Exposure through wearing clothing insufficient for bodily protection, and reduced resistance through wearing clothing that is too warm are frequent causes of susceptibility to disease. A knowledge of the appropriateness of different fabrics and garments for various conditions of season and occasion, from the standpoint of health, should be one important result from the study of clothing.

Problems of heating, lighting, ventilation, and the disposal of waste are health questions related to the study of housing or shelter as a part of industry. Cleanliness in matters of food, clothing, utensils, household furnishings, and tools is a vital health problem. Many of the units in industrial arts provide us with the information that makes for wholesome intelligence and attitudes in caring for health, giving reason and reënforcement for the formation of health habits.

2. *The economic purpose.* Every purchase we make brings up a problem of both the quality of the material and the proper money value of the article secured. How are we to know what foods to select which will give us just the kinds and amounts needed at a cost that is within our means? How are we to know whether a given textile fabric or garment is of good material, well made, and worth the amount asked for it? How are we to know the real values of pieces of household furniture, of utensils, of table wares, and of other products of industry? The proper study of the industrial arts gives us the basis of judging for ourselves the economic values of products. We learn of the materials entering into these products and of the processes by which they are made with special reference to their values in serving their purposes. If we knew the kinds of cotton and woolen mixtures, cotton and silk mixtures, and cotton and linen mixtures, respectively, entering into certain kinds of fabrics, and how these mixtures differ in durability and permanence of surface appearance, and if we knew how to test and recognize these mixtures as well as pure fabrics,

we would be more able to select and purchase fabrics and garments with real economy than if we knew nothing of the content of textiles. If we knew the actual nutritive values of many of the inexpensive foods and how these may be properly cooked or prepared for use, we could substitute some of these for more expensive foods and live quite as well from the standpoint of health at a relatively small cost and without much sacrifice of taste.

3. *The art or æsthetic purpose.* It is desirable that we be surrounded with things that are beautiful rather than with things that are ugly. With the proper training, one may choose his clothing, household furnishings, utensils, and other industrial products with much satisfaction in their art elements. One of the large purposes of the study of industrial arts is to cultivate æsthetic taste and discrimination. There are high standards of art as applied to materials which have been established through the work of many generations by those whose taste has been most refined and most highly cultivated. It is possible for every one to learn the more simple principles that have been developed and to increase his own liking for products which show the best applications of these principles. Of course, people do differ in their capacity to appreciate fine design. Few have a high order of capacity for creative work in design. But all have some capacity for appreciation, and this can be so cultivated as to make possible a considerable degree of satisfaction and success in judging of qualities of beauty in products.

For our people as a whole, the large art problems are those of selecting, purchasing, and using clothing, furnishings, utensils, and other material supplies of various kinds. There is a problem in selecting these from the art standpoint often quite as large as from the economic standpoint. Even health considerations are sometimes sacrificed to art interests. This is notably true with reference to clothing and particularly to shoes. The selection of many industrial products often includes consideration of the three factors, health, economy, and beauty. With a well-developed art sense, selections may usually be made which are in good taste, not in conflict with the laws of health, and not at a cost that is beyond one's means. In every field there are products of excellent taste that are not highly expensive. To be able to select and have that which is beautiful and in good taste without spending money in excess of one's income is a need very real among many of our people and one which we should make every reasonable effort to meet.

The study of the industries with constant attention to the element of design in each individual product, and in compositions in costume, household furnishings, and other combinations of harmonious and pleasing effect is the most promising method of cultivating taste in the selection of industrial products. With children, the study of the principles of design will have little practical effect if they are not studied in direct relationship to the objects of everyday life to which they apply.

4. *The social purpose.* With the modern development of machinery, power, and the factory system with its specialization of work, many conditions have arisen which easily lead to injustice to employees, employers, or consumers. In some industries, the proprietors have found child labor profitable to themselves. Children so employed often have their health undermined, they are deprived of an education, and they come to adulthood unfitted for the full opportunities and duties of citizenship. They tend to become a public charge, or even a menace, because of their ignorance and their unwholesome attitudes of mind. Some industrial

employers have maintained continuous production, keeping their employees at work for seven days in the week. Some have kept men at work for twelve or more hours a day. The unsanitary conditions in many working places have been a menace to the health of their workers. Employees have at times put out work into homes where garments and other articles have been made by persons who had contagious diseases, or where very young children were made to do work for which they were entirely unfit. Workers have formed themselves into unions to try to secure reasonable conditions for work, humane treatment, and reasonable wages. Employers have formed associations among themselves. Because of disputes between the employers and the employees, the consumers have often suffered great losses and inconvenience. Corporations have controlled the production, distribution, and prices of numerous industrial commodities, often seemingly at the expense of the consuming public. Advertising of commodities has often been flagrantly untruthful or misleading. Foods have been exposed under conditions which make their use a menace. From problems relatively small and local to those of nation-wide magnitude, there have been conditions which have called for action in control and regulation. The Consumers' League is a voluntary organization by which many individuals may act together to aid in enforcing satisfactory standards of working conditions by refusing to use the products of any employer who will not maintain such standards. Pure food laws, child labor laws, and laws regulating the hours and conditions of labor have been employed to help in maintaining reasonable standards in the production and sale of commodities.

In these matters of social control every one is concerned and responsible. In some kinds of problems each consumer is interested personally because of conditions which directly affect his own well being. In other kinds of problems each is concerned because of his responsibility as a citizen for the well being of others, although some of these others may seem very remote. But in a democracy we are all personally and collectively responsible for conditions, subject to control, which affect any of us. If any one suffers injustice or injury which we could prevent by working together, then we are all and individually responsible for such injustice or injury. By accepting the opportunities of our democracy, we also assume the obligation to do all we reasonably can to regulate conditions so that both employer and employee shall be able to live their lives with treatment as fair and humane as that which we desire for ourselves.

To realize this social purpose of the study of the industries, we must have the knowledge of conditions and problems in many specific situations which will make us genuinely aware of their existence and nature. The need is for such an intelligence about industry as we may secure only by following through in considerable detail the step-by-step changes from raw materials to finished products in many important industries. Acquaintance with the problems and achievements of people generates interest in them and sympathy for them. Those whom we find patiently, efficiently working to produce the goods which bring satisfaction and pleasure to us as they meet our needs become our neighbors in spirit and sympathy whether they are near us or remote from us. The social purpose in the study of the industrial workers and their work is realized in the measure that this study helps us to be intelligent and sympathetic in the regulation of the conditions of production so that employers, employees, and consumers shall all receive complete fairness and justice in the production or use of products.

5. *The recreational purpose.* The materials, processes, and products of industry appeal to our intellectual interests. Our curiosity as to what things are made of, how they are made, and what they are used for leads us to ask many questions. This interest is strong in early life, but if it has little to satisfy it, it will tend to grow less and to be crowded out by other interests. By the study of the industrial arts, however, new problems are continually appearing which stimulate curiosity, challenge inquiry, and reward investigations by the satisfactions of understanding and achievement. These studies in industry not only help to develop and direct this form of curiosity, but they provide growth at the same time in intelligence about the means by which man supplies himself with products to meet his needs. By these studies, the activities of men become increasingly meaningful. Industry has a significance entirely lost to those who know nothing of its processes and detailed achievements. A lifelong interest may be developed in the activities of industry so that one will find satisfaction and pleasure throughout the years in noting the discoveries, inventions, and new uses and applications of science in industrial production. Such an interest as will lead one to read with satisfaction from week to week or month to month the current reviews of science, invention, and industrial progress in popular or semi-popular magazines is worth while. This kind of reading habit may easily be stimulated and formed n the elementary school period. To develop an intelligent, permanent interest in the changes and progress of industry is believed to be a worthy purpose in the study of the ndustrial arts. This purpose may be realized in part as a by-product of the study with reference to other values, and n part by attention to those phases of industry which nay have little value in other terms but which do satisfy

curiosity relative to materials, processes, or principles used.

Accessory purposes in the study of the industries. The five purposes which have just been described may be regarded as fundamental. There are certain accessory or subordinate purposes, some of which were once regarded as fundamental or primary in the school work with materials. These are such objectives as the development of manual dexterity; coördination of hand and eye; cultivation of a sense of form; developing a love of bodily labor; cultivating patience, persistence, neatness, and accuracy; and developing powers of observation. All of these, however, as far as they may be developed at all in the elementary school, will be developed as by-products of the work as it is properly directed toward the realization of the five foregoing prominent objectives.

Outcomes of the study of industrial arts. While the purposes stated in the foregoing paragraphs indicate the ends for which the work is planned, it will perhaps help to state the expected outcomes in a slightly different form. What effects as a result of the work are expected upon the behavior of one who has studied the industrial arts? The answer may be expressed in this way: One who has properly studied the industries should:

1. Be aware of general health needs, be able to select and use foods and clothing so that they will help to keep him well, and be intelligent about all phases of cleanliness and sanitation in and around the home. This is the health outcome.

2. Be able to buy and use industrial products of good quality in material and construction and well adapted to their purposes, at costs that are reasonable; to care for what is secured so that it will remain serviceable in its fullest pos-

sible measure; to repair, or supervise repairing, when it can be done to advantage; and intelligently to substitute inexpensive for expensive products when this is needed. This is the economic outcome.

3. Love that which is beautiful, and be able to select and use products which are beautiful in themselves, which are well adapted to the particular purpose for which they are chosen, and which fit harmoniously the surroundings in which they are placed. This is the art or æsthetic outcome.

4. Be sensitive to the well being of industrial workers, understand the conditions of the industries, and respond intelligently in all ways possible to help in regulating industry so that no one will suffer injustice or injury for the sake of unfair profits for employers, unfair wages for employees, or unfair prices for consumers. This is the social outcome.

5. Have permanent interests in the materials, processes, products, and achievements of industry which express themselves in observation and reading of the changes, discoveries, and inventions of industry as these are found in operation or described in current magazines or books; or as expressed in avocational construction of products of special appeal; or as satisfied by observing and enjoying products of use and beauty which one may not be able to possess but which are found in the homes of friends, in public buildings, in shops and stores, and in museums. This is the recreational outcome.

6. Be reasonably dextrous in handling materials, tools, machines, and products found in the general environment; be capable of doing or directing the simple kinds of repair work relating to clothing and the household where the specialist is not needed; and have such qualities as accuracy, neatness, and persistence reasonably well developed with reference to their application to the use or upkeep of indus-

trial products. These are the outcomes incidentally developed through the appropriate realization of the primary outcomes.

The purposes of hand work in the industrial arts. In the study of the changes in materials by which they are transformed into finished products, the basis for determining values in the products is often secured best by entering as much as one can into the processes themselves. It is difficult to understand fully what is involved in spinning or weaving, in designing a book cover or a hat, or in making china ware or paper merely by being told, or even by observing the processes. To help carry these processes through by one's own personal participation, to handle the materials, and to see the problems that arise and help to solve them, gives one an understanding and a feeling of intimate acquaintance that can be got in no other way. The primary purpose of the hand work is to help to make meanings clear and to give a reality of personal experience. This makes for permanence of both interest and the possession of values derived as ideas and attitudes or habits. Manual dexterity comes through the hand work largely as an incidental by-product. The work in construction does not call for much skill. If care is used in the grading of constructions, a normal development of dexterity will follow with very little attention to skill as an end in itself.

Another purpose of the hand work, hardly less important, lies in the fact that children enjoy manipulative activities. They often will gladly participate in some form of manipulation without a conscious plan as a first step from which they may be gradually led to interests on higher levels of value. The interest in handling clay may be so directed as to lead to the study of the pottery and other clay industries; making simple play houses may be directed into studies of shelter and furnishings; and the interests in simple weaving and sewing may be developed along lines leading to studies in textiles and garment making. Hand work thus often serves as a means of approach to higher forms of industrial studies, as well as a means of carrying such studies forward with greater interest, understanding, and personal appreciation of meanings and values.

In realizing the purposes here set forth, there will be more hand work required than is usually found in schools which emphasize the development of skill and measure results largely in terms of finished products. Here, the emphasis is upon ideas, attitudes, and habits having to do with health, economic values, and social values, and the hand work is used to help bring out these values. It is a means to a higher end. The interests leading toward the study of the higher values are often initiated through hand work. Children have a strong impulse to manipulate materials, and this impulse may be turned to good account in the development of values altogether higher than those of mere manipulation. In the study of industrial arts the hand work should always be rated as subordinate to the brain work, and supplementary to it.

The purpose and place of excursions. Relatively few industrial processes can be carried on in school as they are in industry itself, and relatively few finished products can be brought to the school. To derive the economic, artistic, and social values for which we are striving, the work of the schoolroom has to be extensively supplemented. Frequent excursions very materially help in securing correct ideas of processes, conditions, and products. Wherever there are industries operative in a community, these should be visited when the work in school in the respective industries is under way. The time of the visit will vary with the purpose. It is often well, when a process has been carried through by hand, to follow this with a visit to a plant where the industrial method may be seen and compared with the method used in school. At times it may be more profitable to visit the plant before the work at school is begun. When a design is to be worked out, it is often wise to visit shops to get suggestions of design as they are used in industry, and to stimulate interest and experimentation.

When selection and cost are the problems, shops and stores should be visited showing varieties of products in various grades of materials, in numerous designs, and in prices of considerable range. This brings the problems of economic and art values before the children in the way most nearly like that by which they are confronted as buyers and users of products. Visits to grocery stores and fruit stores, bakeries, and meat shops may often be very helpful in studies relating to health as well as to economy. Conditions of workers may be noted wherever visits are made and facts brought out for emphasis on the side of either excellence or unfitness as the occasions warrant and as discretion permits.

CHAPTER II

THE SCOPE AND ORGANIZATION OF INDUSTRIAL ARTS

The large number of industries By a rather general classification of the industries, there are over five hundred in the United States. But these may be divided into hundreds more. Specialization has gone so far that there are literally thousands of separate kinds of industrial production existing in our day and generation. If one should analyze the clothing industries into all of their separate divisions, he would find that they include scores of processes so distinct that each is carried on in a separate factory or plant and by workers specially trained for each process. Consider a general list for a moment: The different industries for spinning, weaving, dyeing, and finishing the four staple textile fabrics, cotton, wool, linen, and silk; for making garments from fabrics; for making felts, knitted goods, laces, and embroideries; for making rubber coats and shoes; for making hats, gloves, shoes, belts, buttons, elastics, hair pins and combs, fur products, and ornaments; and for making all of the other accessories used in clothing which one may easily recall with a little reflection. And so, also, for every other large, general industrial field — the food industries, the building trades, the clay industries, the metal-working industries, and numerous others each represents many separate industrial occupations. Even the printing industry, which we often speak of as one field, is made up of about sixty rather distinct occupations.

Necessity for limiting the field of study. The great number and variety of industries make it evident that we cannot study them all. The time at our disposal is not sufficient to permit of the study of any of them that are not of fundamental importance. This book considers the period of the elementary school only. This period is here interpreted as representing school work through the sixth school grade. If we should add to this the three years of the junior high school and the last year of kindergarten work for the general study of the industries, it would make a total of ten years. To give to the study of the industries one period a day through each of these ten years would not provide time enough to study them all in detail. The field must be limited. As we are here considering the work of the elementary school only, it may be well to note its general purpose to see whether it may suggest any basis for limiting and selecting the work of the industrial arts for this period.

The general purpose of the elementary school. The elementary school devotes its efforts to those elements of study which are of common value to all persons without consideration of sex or future occupation. It limits its work to those needs which are common to all in a democratic form of life. This, of course, does not mean that the individual differences of children are not respected, but it does mean that the common elements by which people live efficiently, coöperatively, and harmoniously together are the basic materials emphasized. All must know how to read, write, and use the general processes of number; all need to know the more permanently important facts and meanings of geography, history, literature, and science as these enter into daily life and intercourse. Is there not also a body of experience and knowledge relative to the industrial arts which is of common value to all, regardless of sex or occupation?

If so, this should properly make up the content of the industrial arts as a study for the elementary school to that degree in which elementary school children have the capacity for it.

Determining the content of industrial arts for the elementary school. What we all, as consumers and citizens, need to know and to be able to do relative to the industries is to use their products with intelligence and good taste, and to coöperate intelligently and humanely with others in the regulation of industrial production. In the foregoing chapter, these general aims of the study of the industrial arts were briefly described under the five inclusive terms, health values, economic values, art or æsthetic values, social values, and recreational values. The development of skill in industrial production is left to the later period of vocational education for those who desire to prepare as workers in industrial occupations. The question remaining to be answered is, then, What can children achieve in deriving for themselves these five kinds of value by the time they have completed the elementary school? What can children from about six years of age to twelve or thirteen learn and practice in keeping well, in selecting, purchasing, and using products with economy and taste, in participating in coöperative control, and in deriving recreational values from a study of industrial arts? Since we have found these to be the purposes to be realized by the study, the field must be so limited and the material so selected that the work is constantly directed to specific achievements in the realization of these values.

The limits of the field thus indicated suggest that:

1. Those industrial activities only be selected which have the largest common elements in relationship to these purposes. In other words, that field of industry comes first

which has the largest relationship to the common needs of life. Those industries having least relationship to the common needs of life would be omitted, judged constantly, as they must be, from the point of view of the consumer and citizen. By this standard, industries devoted to the production of food, clothing, and shelter would stand at the top of the list, those concerned with the making of walking sticks or artificial limbs would be omitted.

2. Within any industry selected because of its importance to life, those parts would be chosen which furnish the greatest help in meeting our common needs. Not all phases of even a single industry may yield values in terms of our purposes sufficient to make it worth while to include them. For example, a study of the materials and processes employed in the clothing industries provides much help in problems of selecting clothing, but developing skill in any of these processes yields little that is measurable by our standards of value.

Chapter XIII gives an historical summary of the different objectives for the use of materials in school. By considering the problem of selection and organization by means of a review of past attempts, we may find aid in arriving at a more satisfactory basis. The more important plans under which work with materials has been organized for the schools are briefly summarized in the sections following.

Organization upon the basis of manipulative processes. The earlier work in the use of materials in schools under the term *manual training* made capacity for manipulative activities the basis of organization. For the lower grades, materials were found which could be handled with ease by young children, such as paper, cardboard, raffia, clay, and coarse yarns. It mattered little what the material was so long as it was easily manipulated, and could be made into pleasing shapes. As ability to handle more refractory material grew through the middle and upper grades, wood, textile fabrics, thread for weaving, leather, metals, reeds and splints for basket weaving, and food materials were added. These materials were made into more or less useful articles, although the purpose which a product might serve when made often received little consideration in planning courses. The measure of success was the degree of skill in manipulation developed as shown by the excellence of workmanship in the finished product.

By this organization, selection of materials and processes included no reference whatsoever to the values representing the life purposes served by the information, attitudes, and habits in meeting our needs as consumers and citizens. There was practically no body of thought or feeling developed except that which was inherently incidental to the manipulative activities. From the standpoint of everyday needs, we have almost no basis for judging of the worth of this work. Any material was welcomed which children could handle with some facility, and for which we could devise patterns which would appeal to their interests. Naturally such a subject was an " unprepared " subject; it had little respectability; it had no place as a " regular " subject; and it was not rated as having any credit value—it was not considered as counting for or against a pupil in matters of promotion. Evidently an organization on the basis of manipulative processes is wholly inadequate when measured by standards representing specific life values.

Organization upon the basis of self-expression. Through the kindergarten and fine arts influences, attempts have been made to organize work with materials upon the basis of the expressive impulses of children. All children have some interest in creatively expressing thoughts and feelings through materials resulting in products which may or may not serve any useful purpose. It is enough if the expression results in the growth of control of the materials used to a degree that brings satisfaction in the products as objects of either use or beauty. The creative impulse is growing, and it is free from any limitations which might be placed upon it by any prescribed set of models or by subordinating it to the service of utilitarian purposes. From this point of view, materials and processes are chiefly of value as means for expressing the children's ideas of design and decoration.

While it is true that it is very desirable that children should have much opportunity to express their ideas and feelings of form and color in materials, it is at the same time submitted that this alone gives little basis for the consideration of the values relating to our problems of life as consumers of industrial products. It is also very difficult to organize work in a sequence that is adapted to class usage. Children differ individually in their capacity for creative expression more than in any of the other qualities relating to the various aspects of industrial arts studies. By a more inclusive basis of organization, other values may be realized and, at the same time, very wide provision may be made for self-expression. Under a more inclusive plan, no children need be deprived of an opportunity for the development of creative ability unless it be the very few of exceptional talent in this capacity. Those of rare talent should probably have special treatment, when they are found, providing more extended opportunity for the growth of this capacity. Probably, however, not more than one child in five hundred has talent of an order which would justify such special treatment. If there are as many as one in five hundred, this means that there are to-day in the United States over fifty thousand such children of school age, and this seems to be a number quite large enough to include them all.

Organization upon the basis of the historic sequence of industrial development. An organization of the industries on the basis of the changes through discoveries and inventions from the days of primitive man to the present time has been developed and used in some schools. By this organization, the lower grades consider the most primitive materials and methods of production in the most important permanent fields of industry. The steps forward through the later ancient, the medieval, and the modern periods are studied as we pass upward through the grades. By this organization comparisons are more or less continuously made between present-day methods of production and those of the past. But present-day methods, problems, and values are relatively neglected. The standards we have set up are not considered definitely, although much which contributes to their realization is implied.

The subject matter and processes brought out by this organization do possess very great value in helping us to understand and interpret the meanings of the processes of industry as they are carried on to-day. But these same elements of subject matter may be utilized by another form of organization which does not neglect the values in which this plan is weak. This evolutionary organization was the first to help us to get a perspective of man's slow industrial development and to emphasize the close relationship between the changes in industrial life and the resultant changes and problems in social life.

Organization upon the basis of materials. The five dominant industrial materials are foods, textiles, woods, metals, and clays and other earth materials. An organization on the basis of these five groups of materials, noting the changes in each as it is carried through the processess from raw material to finished product, was experimentally developed in 1910. The simplest processes in the industrial changes of these materials were placed in the lower grades, and the increasingly difficult processes followed in sequence upward through the middle and higher grades. The values emphasized were those of health, economy, and art from the point of view of the consumer.

While this plan emphasized some of the values which we consider of the greatest importance, the organization was somewhat artificial and arbitrary, and its application was found difficult. To consider the industries which have to do with wood as a material brings together for study such differing problems as furniture making, house building, shipbuilding, paper making, tool making, the making of vehicles, cooperage, box making, and some other industries, alike only in that they use wood as a material. Metals have a very wide range of usage. Clays enter into several important industrial fields as far removed from each other as chinaware and sewer pipes. Taking units of work from these various fields representing the respective materials for each of the grades was an artificial plan of organization which gave little sense of unity or continuity. The course seemed to be but a collection of fragments. From the standpoint of the uses of products made by man, it soon became evident that there is no unity in the materials as materials. Some more fundamental basis of classification was needed, and the basis in materials was abandoned as soon as a better plan was developed.

Organization upon the basis of the uses of products. The large uses of material products center very conveniently for classification about the needs of man for six kinds of service, which are, respectively: food; clothing; shelter; utensils;

records for transmitting experience; and tools and machines. The subject matter making up such an organization is found largely in answer to the two questions: (1) What are the changes made in materials which increase their values to make them most useful and satisfying in meeting these six respective forms of need? (2) What are the problems relating to these changes which concern us as consumers and citizens?

To the question, How have we supplied ourselves with clothing in a measure sufficient to satisfy all of the needs and interests we have for clothes, an adequate answer requires a breaking up of the problem into its more essential elements. By this means we are enabled to consider it in relationship to all of the five objectives which we have earlier set forth for each of the large fields of industrial study, namely, health, economy, taste, social relationships, and recreational interests. So, also, may we deal with the same question asked of each of the other five fields representing our principal needs for industrial supplies.

In considering the means by which these several kinds of value are to be developed relative to our needs as consumers and citizens, it will be found that we shall be required to call upon some features that are prominent in the work as organized about each of the other bases indicated in foregoing paragraphs. Some values are brought out best through manipulative activities. Hand work in the making of products teaches methods of construction and the relationship of these to the quality of the materials and products, and helps in the understanding or interpreting of methods more complex than those which can be used in schools. In every construction project there is also an opportunity for self-expression in its design and decoration. We shall also have to consider the historic discoveries and inventions of the race in industrial production to secure aid in interpreting many of the more complex methods of the industries of to-day in which factory or machine production is very prominent; to get some basis for a perspective of the means by which industrial changes have come about; and to see how these changes have affected social life and the lives of industrial workers. The marvels of ingenuity achieved in adapting a relatively small number of materials to a range of purposes so great as those found in the study of the important industries can hardly fail to stimulate an intellectual curiosity that will tend throughout life to find satisfaction in learning of the new adaptations resulting from discoveries and inventions yet to be made.

From the practical side of the organization into a course of study, the basis of usage of products removes the difficulties of a plan based upon the materials themselves. In clothing, there are numerous materials other than textiles — leather, furs, rubber, and quite a number of accessory materials. But as clothing, rather than textiles, is the unit, there is no difficulty in considering anything found useful as serving a clothing purpose. In shelter, it is the house and its equipment and furnishings which constitute the unit, and not wood, or stone, or clay, or metal. The house may be a combination of two or more of these materials. Whatever its component materials, the organization is centered upon the purposes and uses of shelter as these are accomplished by various materials adapted to needs, and not upon the materials themselves.

Organization upon the basis of usage is comprehensive. Whatever there is of genuine value in any plan for the industrial arts may be included under the organization upon the basis of usage. That emphasis which is most important in realizing the purposes of the study should be most prominent in determining the organization. It has been stated in various ways on preceding pages that the only justification for the industrial arts work lies in the desirable changes in behavior which it will bring about in one's selection, use, and enjoyment of the products of industry; in one's participation in the securing of just and fair treatment for producers in industry and for consumers of products; and in one's taking an intelligent interest in the processes, products, and workers in industry as changes in these result from the use of new materials and methods. Whatever will contribute largely toward bringing about desirable results in behavior along these lines is to be regarded as worth while. We do not hesitate to take any good features from any organization proposed, even if most of the features of such an organization are fundamentally inadequate or poor. The weaknesses of most of the organizations for the study of the industries has been in their overemphasis of some relatively unimportant phase and their neglect of other phases altogether more important. It is only since about 1910 that there has been any definite attempt in schools to study the industries as they are carried on in the most modern ways. The earlier manual training made no attempt to study industry as it is. One might become quite proficient in the use of hand-working tools in a school, and be able to make quite creditable pieces of furniture without learning anything of the way in which most furniture of the present time is made in factories. None of the values we have pointed as dominant were included directly as aims. The old forms of the work represented a subject without a subject matter other than that of mere hand technique. It was a system of manipulative activities for the development of either skill or self-expression, and it had no body of thought or appreciative content. As the study is here conceived and presented, the industrial arts includes a body of ideas and meanings, and of interpretative and expressive activities, attitudes, and habits. The outcomes of the study are found in the operation of these experiences in the control of one's conduct whenever conduct relates to the use and enjoyment of industrial products, to the regulative problems of industry, or to the interpretation of new methods of production.

Developing an organization for a course of study. In making a course of study on the basis of the six units of usage into which we have divided the field of needs served by industrial products, we have first to consider the content of each unit as a whole. The question which we have to answer for each is, What can we achieve in realizing the values expected of this unit by the end of the elementary school period? In the clothing unit, for example, our first problem is to list the values in very definite, specific terms for the whole elementary school course. Having done this, our problem is then to organize the sequence of the work. Of all of these problems to be taken up to result in information, habits, attitudes, and appreciations, which problems are within the range of capacity and interest of children of the first grade? Of the second grade? And so on, until we have sequentially distributed the work on clothing pedagogically among the six grades. The same procedure applies to each of the other five units — foods, shelter, utensils, records, and tools and machines.

Of course, before a final assignment of work can be made to any given grade, other subjects and interests have to be taken into account. The study of the industries cannot be isolated from the work in most of the other subjects without very serious loss, both to itself and to the other subjects. The unification of experiences in each of the grades which makes for economy in learning and in time and for breadth and intensity of thought and interest, is a very important phase of the work of curriculum making. The more intimate relationships of the industrial arts and other subjects are considered in some detail in Chapter V.

Lines cannot be sharply drawn between the grades in the distribution of work. Some problems may be almost equally well adapted to second or third grade, or others to fourth or fifth grade. But suggestions of sequence may be reasonably definite and yet provide for sufficient flexibility to permit of needed variations and adaptations. A suggested organization of the work for each grade in each of the six fields makes up the content of Chapters VII to XII inclusive. At the end of the work for each grade is a statement of the outcomes which it is expected that the work should produce. By consulting these, the teacher is helped to emphasize those aspects of the work which contribute most to the realization of its specific purposes and values.

The organization of the chapters which constitute a course of study is rather comprehensive, and the work suggested for each grade probably includes more than most schools can do in one year. But from such a course, units may be selected on the basis of relative importance and worth as adapted to the time and other conditions of almost any school in either city or country. Attention is directed to the fact that the work is presented as *suggestive*. This is to be interpreted as meaning that the teacher should always use judgment and feel free to select from the material offered only that which she can most appropriately use, or to substitute other constructive or investigative activities for those given when the substituted projects will better serve the purpose.

The outcomes and subject matter are to be regarded as relatively constant for all schools. But the particular interest and activities by which the subject matter is approached and the outcomes realized may differ as widely as environing conditions differ. It is a part of the teacher's problem to use such points of contact as are offered by the environment of her own class. At times she may need to create the desired direction of interest by skillfully suggesting questions for initiating investigations and other projects. The past experience of the children, the present environment, and the current interests of community life and of the larger life of the world, as a whole, should all contribute in determining the immediate forms of approach to the values to be realized in the industrial arts as well as in all other subjects of study.

CHAPTER III

THE PSYCHOLOGY OF INDUSTRIAL ARTS

Impulses used in the study of industrial arts. There are at least four forms of impulse to expression or action which find satisfaction in the several phases of the study of industrial arts

1. *The impulse to manipulative activity*, resulting in the handling of materials and tools, and, in time, the using of these in constructive and investigative activities.

2. *The impulse to investigate*, expressing itself in inquiries about constructive methods, kinds and sources of materials, uses of materials and products, the operation and explanation of devices and principles of machines and constructions, and the relationships of practical activities to human purposes.

3. *The art or æsthetic impulse*, which finds satisfaction in the enjoyment of beauty in form and color as observed in materials and products, and in creative production by the designing and constructing of new products.

4. *The social impulse*, leading one to observe what others are doing, to attempt to share with others their activities, and to secure from others their approval and coöperation in furthering one's own activities.

While these impulses are the chief sources of the practical activities spontaneously engaged in by children, they become associated with many complex forms of inquiry and many intellectual and social problems stimulated by human purposes and values. To account for all of the stimulating elements that may enter into any given unit of industrial arts work may require a number of factors other than these four impulsive tendencies. Yet, basically, whatever self-expressed, driving force there is in the study will rest primarily upon the operation of one or more of these impulses.

The development of these impulses. In many forms of activity, two or more of the four impulses are operative at the same time, and the satisfactions coming from them are complex. It would be difficult to indicate the order of the development in time of these different impulses as the child grows. By the age of school life, all have been operative for several years. The manipulative and the investigative impulses are probably most prominent at this period. While all are developing together, the relative part which each plays in bringing about forms of activity changes as age and experience increase. Individual differences are great in the relative potency of the impulses. In some children, the manipulative impulses are stronger than the investigative, in others the reverse is true. In a few, the art impulse is strong. With many children the manipulative impulse may be very strong for several years and then seem gradually to become subordinate to investigative or art interests.

Considering each of these impulses with reference to its general development may be helpful in furnishing a basis for the selection of kinds of industrial arts problems best suited to satisfy the children's needs from year to year, and, at the same time, direct the work toward the most important life values. A brief analysis of such development follows.

1. *The manipulative impulse.* The first forms of manipulation are aimless and planless. The activities are largely sensory and motor, and the satisfaction is in the activity itself together with its sensory resultants. Merely han-

dling materials and tools, as tearing paper or cutting it with scissors, pounding or driving nails with a hammer, running the sand of the sand table through one's fingers, squeezing or patting clay, and piling up blocks and knocking them over are examples of manipulative activity appearing in children of kindergarten or first-grade ages. Gradually a second and higher form appears when an aim or conscious purpose enters into the activity. Making a wagon or a sled with the wood, nails, and hammer, making a mountain or a roadway of the sand, making a pie or a dog or a dish out of the clay, and cutting a house or a doll out of the paper are examples of this second form of manipulation. There is an aim of something to be made, but no plan as to details. Satisfaction comes from both the activity itself and the achievement in making some kind of product, crude as it may be. The third form results in constructive activity with a definite aim and plan. Not only is the final product imaged, but the detailed parts and the respective steps in the construction are thought out. The wagon to be made is to have wheels of a certain kind and size, and other parts are to be of specific form and size. The product to be made of clay is definite in shape and dimensions. Here the satisfaction is in the product and the activity. If the product does not somewhat closely approximate the plan, there is little satisfaction with the work. The skill motive emerges because it begins to have value as a means of achieving a desired result.

Further development of the manipulative impulse, as such, lies largely in the increase of skill in the production of clearly projected objects or in the development of skills associated with other purposes requiring manipulative technique. For many, the mental elements which grow from the investigative impulse take a larger hold than the manipulative, so that for such persons the constructive activities themselves become subordinate. They become means to investigation rather than ends in themselves. Reference to this will be made again in subsequent paragraphs.

2. *The investigative impulse.* Questions of "What?" and "What for?" lead children very early to make many observations and explorations and to use much bodily activity. Their aims and activities are casual and vague in their early years. Mental activity and bodily activity are often combined. Satisfaction lies in the activities themselves and in the information resulting.

A higher development of this exploratory impulse appears when the element of "How?" enters. When this form develops, more definite forms of activity, both bodily and mental, result through experimentation and trial-and-result methods of answering questions. Manipulation and investigation are often combined. "Making it this way to see how it will work," "Making a roller coaster that you can guide as you do an automobile," "Making an engine out of tin cans," "Making some chocolate drops like those you buy," and "Making some cakes and having a tea party" are examples of investigative problems that require manipulative activities. Examining automobile engines, visiting factories and shops, watching the operations of derricks, street sweepers, fire engines, threshing machines, hay presses, tractors, locomotives, boats, and other mechanical devices, and asking questions about almost every form of device or machine as to "how it works" are characteristic and familiar evidences of this second level of investigative activity. As a source for answering questions, descriptive reading matter may also be used. Satisfaction is derived from the mental activity and the information gained, and also from the bodily activity used in the experimentation and excursions. To find out the purposes and meanings of operations seen gives satisfaction.

Still a higher level of investigation is reached when the question, "Why?" is added to the "What?" "What for?" and "How?" When this interest develops, the manipulative impulses tend to become almost wholly subordinated to purposes of investigation. Such manipulative activities as are engaged in are largely those required in experimentation. Reading now becomes a prominent means of answering questions. Curiosity has become "scientific." The satisfactions are largely in the mental activity involved in the investigations, and in intellectual appreciations — the joy of knowing and of finding out.

3. *The art or æsthetic impulse.* Children early manifest an impulse to notice brightly colored objects and to collect and handle these; to show preferences for clothes, household furnishings, and other objects which are highly colored; and to draw and color or model forms in imitation of objects of general interest. Satisfaction lies in the sensory activity stimulated by form and color as observed, and in the manipulative activities involved in making drawings and paintings or models.

A higher level is reached when elements of proportion, balance, and relationships of harmony begin to be operative in the preferences for objects observed, in choices of products used, or in the designing of products. Satisfaction is in the responses to the sensory stimulations, and, in addition to these, in the creative activity in the designing of products. In everyday life, the art impulse expresses itself most fully in the effort to be adorned with clothing and provided with other personal properties which bring satisfactions in form and color. It soon becomes difficult to determine to what degree choices are individual, as this impulse is very markedly modified in its forms of expression by the influence of others.

4. *The social impulses.* The earliest form of the social impulse is expressed largely on the plane of mere gregariousness — the desire to be with others. Gradually the desire grows in one to share with others what they are doing and to have others participate in one's own activities. It is found through experience that others may help one to carry on one's own plans, and that there are definite values in group coöperation. Exchanges of ideas are profitable, and division of work in a problem of common interest results in the achievement of much more in both quantity and variety in a given time than one could accomplish alone.

From experiences in sharing constructive and investigative problems with others, the facts of interdependence are discovered. The division of labor and coöperation of the practical world are observed. From both personal experience and observation, the meaning of interdependence among all may become clear. An appreciation of this fundamental fact of the dependence of each upon all and of all upon each, if stimulated, will readily lead to feelings and meanings of personal responsibility for the conditions of life and the well-being of others about whose work one becomes interested.

The social impulse also finds expression in a desire to adopt the standards of usage of others — to dress and to furnish one's house as others do, and to have such properties as are possessed by those whom one respects and whose approval one wishes. The art impulse and the social impulse sometimes come into conflict, as when one sacrifices his own choices in form and color to standards socially approved, or when he sacrifices social approval to personal choices.

The development of habits from impulses. While these native impulses furnish the drive for the activities described, they probably do very little to give them definite direction or form. Experience and selection determine the habits which grow from the activities. The impulses provide the possibilities, but experience, results, satisfactions, and surrounding influences bring about the selective growth of particular forms of constructive, investigative, æsthetic, and social habits and attitudes. The activities and the products of the environment and the approval of others are the influences which most profoundly affect the selections of children and determine their interests and habits. Encouraging children to investigate, teaching them methods which bring success, and approving their investigative activities and results will bring about a development of this impulse not found in children not so encouraged. In a similar way these other impulses may be developed into effective habits or attitudes by proper influences, or they may be largely inhibited by neglect or discouragement. Nature but furnishes the tendencies to act in these desirable ways and the satisfactions coming from their activity. What they actually become as skills, interests, attitudes, and appreciations is a matter of educational direction.

How industrial arts should utilize these impulses. In a foregoing chapter, the purposes of the study of the industries most emphasized for the elementary school were stated as relating to health, economic, and art values in the selection and use of industrial products; and to social values as related to the effective regulation of production, distribution, and use of products. These values are to be accomplished by utilizing the impulsive tendencies to activity which have been described in preceding paragraphs. For children, the earlier expressions of interest are in the manipulative and investigative forms of activity with almost no relationship to adult standards of worth. But, as intellectual and social interests develop, it becomes increasingly easy to direct the constructive, investigative, and art activities into forms which are large in the values which we desire to cultivate. From interests merely manipulative and investigative, attention may be gradually transferred to questions and problems of health, economy, and art, by the use of constructive and investigative methods of work as means of answering these questions and solving these problems. Manipulation may become a matter of constructive and experimental dexterities and skills for meeting one's practical needs. Investigation may become a habit of open-minded inquiry and method in solving practical and intellectual problems. The art interest may become an attitude and method for the selection of properties and objects for contemplation which yield enjoyment because of their beauty. From the social interest, there may be developed an attitude and a method of behavior relative to the well-being of others.

Factors of growth affecting appropriate selection of work. Certain facts of growth, both physical and mental, have bearings upon the selection of problems. Among these the following are important:

Physiological factors. In children of the first three or four years of school life there is a very uneven growth of bodily parts. This, together with the fact that the nervous coördination of muscles has not yet become well developed, causes clumsiness in the use of the limbs. The child should not be blamed for the resulting awkwardness, as he cannot help it. Gradually through these years the trunk, limbs, muscles, and nervous controls become more fully developed and this awkwardness disappears. Observing the way in which children of these respective years handle a base ball will give evidence of this growing control. In the early school years, the muscles are short, low in elasticity, and of small leverage. At the beginning, the large trunk muscles are more fully developed. Systems of coarser and finer muscles have not yet come to support each other perfectly. Strength is not great, but it rapidly increases, nearly doubling as shown by hand grip from six years of age to nine. Because of these conditions, children in the first school years are not capable of very fine, very precise, very swift, very strong, or very long-sustained motor activities. To insist upon work requiring very much of any of these qualities is probably harmful.

As we pass upward through the fourth, fifth, and sixth school grades, there is marked increase in strength, control, and steadiness. Work requiring greater strength, precision, and endurance may be engaged in without undue effort and without danger of injury. During the ninth and tenth years, there is relatively small growth in either height or weight. But usually in the eleventh and twelfth years there is a period of very rapid growth in height. Up to about twelve, this rate of growth is about the same for boys and girls, but at this time girls begin to grow much more rapidly than boys, so that near the end of the twelfth year girls exceed boys in height by almost two inches. Girls frequently grow as much as two and a half inches in height in a single year. The next year growth falls back to a lower rate for girls, but boys begin to grow so rapidly that by fourteen they are taller than the girls. While growth in height is rapid, growth in weight is relatively small. Marked increase in weight usually follows a period of rapid growth in height. During this period of rapid growth in height, there is often an actual loss in motor control. If, during this period, when children seem to be doing their best and results are no better than those of a year or two earlier, or perhaps not even so good as earlier, the children should not be held blameworthy, as their control may be actually less exact than in the preceding year. Nature is making many changes in the body that are of great importance, and care should be used to avoid both injustice and injury by asking for work that does not demand a bodily strain that is too great. This condition is usually temporary, and improvement will appear again after the period of rapid growth in height is passed.

Mental factors. The mental life of children of the first two or three years in school is characterized by a large interest in sensory activity – in sights and sounds, in handling materials and tools, and in relatively coarse constructive activities. Curiosity is very active, leading to much investigative learning through trial-and-result methods. There is a weak power to project ends, and the interest span for an individual purpose or problem is short. There is a strong and growing interest in the practical activities of the adult life of the community. This interest, combined with the impulse to manipulate, leads to the making of miniature vehicles, utensils, houses, roadways, and other products suggested by environment and adult activities.

There is little power, relatively, to analyze situations and objects, and there is therefore little interest in form, structure, substance, or any abstract relationships. The interest is largely in the element of use — What can a thing do, or, What can you do with it? Inhibition is weak, and ideas tend to pass at once into action. Whatever is new or whatever breaks up the common routine is attractive. Holidays, pageants, the circus, parades, picnics, and other occasional events appeal to the imagination and are of great interest. The planning of work must provide for much variation in detail to hold interest for any continued period. The social consciousness is relatively weak, the child not having learned how to play or work well with other children.

In the years of the middle grades, there are many changes in these mental activities and attitudes. The interest span increases; ability to plan grows; inhibition is developed and unchecked, impulsive action grows less; the interest in the practical activities of the community grows into an interest in the means by which results are secured and becomes strong in mechanical devices, machines, and the application of power; and the ability to play and work effectively with a group develops, making possible many coöperative activities and much team work. Patience is developed for mastering such controls or skills as are needed to bring about desired results. Power to analyze and to see relationships has developed, which makes possible studies of much wider range of meaning and extent. Interest develops near the end of the elementary school period in clubs, associations, or other limited coöperative groups.

About the eleventh or twelfth year there develops an interest in heroic characters. Those who have achieved great results by overcoming obstacles are admired, and there is often expressed a desire to emulate them. The heroes of history and fiction make strong appeals. Curiosity tends to become scientific, and this, together with a tendency to become subjective and introspective, gives science, religion, and social relationships a place of much importance if presented in a natural way. There is often a tendency to moodiness. There is a great dread of ridicule and a strong desire for approbation. It is a time of much exploratory interest, and a time when much may be done to broaden interests in human affairs, problems, and values. It is a time when sympathy and wholesome, interested discussion of one's personal problems are desired and appreciated.

Occupational guidance becomes important as a personal issue for many children. A consideration of the industrial occupations from the point of view of what they have to offer as a life work appeals seriously to some. Children may well be introduced to the life stories of many heroic discoverers, inventors, and pioneers as a means of stimulating and directing their interests and ambitions.

If the teachers know the physiological and mental characteristics of the children of their classes, it will help them to select the work adapted to the needs of their pupils, and enable them to avoid work for which there is not a state of physical or mental readiness. The foregoing factors, together with a consideration of the impulses described at the beginning of this chapter, should furnish a basis helpful in the selection and organization of the work in industrial arts.

The question of skill and of manual dexterity. Since the purpose of the study of the industries in the elementary school has to do primarily with the problems of the consumer and citizen, productive skill is but a very minor problem. High degrees of skill become important only when the work is taken up with a vocational aim. In the elementary school it is rather a development of general dexterity with a variety of materials and processes than any form of specialized skill that is wanted. It is, of course, desirable that this dexterity should grow from year to year. But, if constructive projects are well chosen from grade to grade in all of the varieties of materials used, this dexterity will grow normally without any special practice for skill, as such. The standard of proficiency in constructive work which should be maintained throughout the grades is that each child should do his best in each piece of work undertaken.

Important elements in motor training. A summary of the points in motor training presented in *The Principles* *of Teaching*,[1] by Edward L. Thorndike, brings out well the most important features of the problem. There are two elements involved in getting results, that of form and that of execution. The element of form has to do with getting clear ideas of what is to be done and how it is to be done. In writing the letter *a*, one may study the copy and also carefully observe how one in making an *a* holds the pen and makes the movements. This is the form side of the problem. Execution is actually doing what is to be done — in this case, making the *a*. Learning to do a thing means getting clear ideas of what is to be done and how it is done, and then trying to do it, comparing results with copies, trying again, and so on. In each trial, selection should be made of whatever tends toward success and elimination of whatever tends toward failure. Self-criticism and directed retrying until all of the right movements are acquired and all others are eliminated is the method by which motor training is achieved.

In teaching children how to carry on the constructive phases of their work, it is helpful to use imitation freely. Showing one how to do a thing is usually much more effective than merely telling him how. Good methods of handling tools and materials should be shown to children, but it must be remembered that they will not all be able at once to conform to these in all particulars. Want of strength and control may make it best for younger children often to use methods of their own until growth makes it possible for them more easily to adopt adult methods. From the very beginning, children should be taught self-criticism — the judging of their own efforts and results by comparison with good copies, and the locating of the particular elements in which they are succeeding and failing.

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[1] Thorndike, E. L. — *Principles of Teaching*, Chapter XIV. Seiler, New York

To avoid fatiguing the children, one should avoid activities which require controls too difficult for children of a given age. Row[1] found that for children of eight years, nine years, and thirteen years, each giving the same period of time to pen writing and blackboard writing respectively, the loss in hand grip, a measure of fatigue, was from twenty-eight to thirty-seven per cent greater for pen writing than for blackboard writing. Probably any activity for children that produces much fatigue in a short interval of time is too difficult for healthful development. It is entirely unnecessary to have any forms of manipulation in elementary school industrial arts work which produce much fatigue when engaged in for a reasonable period of time.

During the period when children "act first and think afterward," much learning by trial-and-result will occur. It is probably worth while to allow children to find out many things by this kind of experimentation when it does not involve the waste of much material or the spoiling of a coöperative piece of work to which a number are contributing. Failure through impulsive action will tend to bring about an attitude favorable to a closer observation of others who succeed, and to the accepting of advice. Gradually the advantages of planning first and acting in accordance with plans will become appreciated. As early as possible, children should be led to see the values of planning or thinking through their constructive and investigative problems before they begin to construct or investigate.

The broader mental aspects of constructive and investigative problems. Problems in construction and investigation may, and should, involve methods of thinking, judging of the value of the thought, judging of forms of procedure, and judging of results. To include these, however, in more than a relatively trivial degree, the activities must include the designing and planning aspects of the work. They must represent the real expression of thought, or a thinking process by which ideas are clarified and enlarged. Questions of What, and How, and Why have to be answered if the work is anything more than dictation responses. Information must be acquired in relationship to the definite problems. The imagination must be used in seeing the procedure as a plan of action to be carried out. If a loom is to be made upon which to weave a rug, the necessary elements required for weaving must be learned and the loom designed to satisfy these requirements. The new processes in the construction must be considered in relationship to their purposes. As the questions are raised and answered, meanings are realized more fully through the actual constructions and the judgments of results than by merely talking and reading about the problems, or even by looking at pictures or models of objects considered. There is something of meaning and significance which attaches to experiences of actual, practical participation which is not realized without it. The realities of experience make for a genuineness and permanence of meaning not realized from the mere getting of information about facts and relationships. To one who has spun a small quantity of thread or yarn, who has woven a small rug, who has constructed a house or a piece of furniture, who has made a piece of pottery, and who has followed through the different illustrative methods of food preservation — to such a person all of the industrial activities corresponding to these have a fullness and warmth of interest and meaning not possessed by one who has not had these experiences. There is an attitude of familiarity with the fields of production and their products, and a feeling of sympathy and comradeship with those who are occupied in their production. The larger and fuller our experience with a thing or situation, the larger its meaning for us.

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[1] Row, R. K. — *The Educational Meaning of the Manual Arts and Industries*, p. 101. Row, Peterson & Co.

Investigation is a means of increasing our information of both facts and their meanings. Values derived are measured by the degree of importance to life of the questions raised and answered. In the study of all of the industrial arts units, in relationship to health, economic, æsthetic, and other values, many questions will be raised which can be answered only by investigations. The more these investigations include some practical activities such as experiments, constructions, and visits, the more effective they will be and the more lasting the results. Of course this does not mean the elimination of books and other printed matter, but it does mean extensively supplementing it, or, more often, supplementing the investigative work by the use of printed matter. Reading will often stimulate certain forms of experimentation and construction, and the practical work done will, in turn, lead to more reading for further direction and for gaining wider interpretations of meanings and applications. In the study of the evolution of printing, there is a place for the making of the stylus and tablet, a scroll, some papyrus and parchment, and some examples of block dyes for block printing; there is also a place for reading about these and about the conditions of life and the peoples among whom these forms of writing or printing were used.

Appreciations resulting from practical activities. In problems of design and selection, elements of beauty make their appeal and offer an opportunity for the cultivation of artistic appreciation. Likings for desirable qualities in form and color may be developed. The participation in designing and making a Greek bowl or vase should lead to a considerable investigation of Greek design in general, and to a comparison of Greek designs with designs characteristically different. Out of the study we may expect some permanent attitude toward the beauty of Greek design. For approaching the study and for making it real and permanent in its influence, we should count upon the practical work of thinking through the design and executing it in the clay as the basis most significant in giving the whole study its personal and vital appeal. Many of the most permanent elements in the teaching of beauty in industrial commodities will probably be those which are experienced as parts of practical problems in design or selection. When from time to time, practical interest in specific elements of beauty is stimulated, supplementary problems may be taken up in the study of related problems in design in its wider applications, thus gradually furnishing the materials out of which the principles of design, as such, are developing.

So, also, may be approached many of the social phases of the study which it is desirable to include. Finding out how some garment we have was made so cheaply may lead to a sweat shop. Finding out about all of the travels of a boll of cotton, of a lump of coal, or of a can of peas or beets may lead to the factory, the coal breaker, or the farm where child labor contributes to the cheapness of price or to the affluence of the employer. In considering the problems and conditions of life of those engaged in the productive occupations and the meanings which these reveal, feelings of human relationships are experienced, and certain attitudes of sympathy may be developed for these and a sense of solicitude for their well-being may be awakened. These feelings and interests open the way to studies in problems and means of social control and furnish the background for much of the content found in good courses in training for citizenship.

These affective or emotional accompaniments of the industrial arts work are of great significance, for they enter fundamentally into establishing attitudes, or mind sets, prepotent for affecting conduct. Practical activities, utilized to their full opportunities, may contribute very largely to the development of permanent intellectual interests, appreciative attitudes toward beauty as a quality of industrial products, and humane social attitudes toward the producers in industry.

The mental stimulation of industrial studies. The problems of investigation in the study of the industries are such as to provide increasing mental activity. They open up and reveal new questions which appeal to imagination and interest. Hardly a problem may be investigated which does not reveal new lines of exploration, reaching into questions of history, geography, and science. It is only when the technical processes of construction are made the aim that the mental phases of the activity tend to diminish through the concentration upon the habits constituting the particular skills. When attention becomes centered upon these processes of habit formation, the tendency is to reduce mental activity as the skill is increased. There is nothing in the form of activity itself to reveal new problems or interests. This phase of the work, of course, has no place in the elementary school in the study of the industries. The problems for the elementary school are those which constantly tend to evoke increasing appeals to interest and imagination, leading on from problem to problem.

Open-mindedness resulting from participation. By the constant practice of investigating, by which questions are answered and new questions are revealed, the interest in exploratory activities is stimulated. The inquiring attitude of mind is developed. Participation in the forms of activity used in making such investigations develops both the habit of participation and the method for making inquiries successfully. The attitude and the use of successful methods of open-minded inquiry may bring such degrees of efficiency and satisfaction as to make the habit of inquiry of lifelong value.

CHAPTER IV

THE RELATIONSHIPS OF INDUSTRIAL AND FINE ARTS

Products include both a utilitarian and an art purpose. It is very rarely that we find an industrial product, no matter what its use, in which there is not evidence of some attempt to make it pleasing in form or color, or both. Appeal is made to our sense of beauty as well as of usefulness. In buildings, furniture, rugs, chinawares, clothing, books, tools, vehicles, and all of the scores of accessory material supplies, we find great effort expended to make each product attractive to the eye as well as efficient in meeting the useful purpose served by it. For many of these products, a considerable part of the price we pay represents qualities not essential to mere use. By simply limiting attention to the actual utilitarian purposes in the making of hats, the best of hats for women could be made for a very few dollars. Dresses and other wearing apparel could be made of excellent material and meet every need of health and comfort for a small part of what is often paid for garments. Tables, chairs, dressers, sideboards, bedsteads, rugs, and other household furnishings could be produced, with consideration to use alone, at costs almost absurdly low in comparison with the prices we are willing to pay for these products as they are made to appeal to our desire for the beautiful as well as for the useful.

Our purpose in securing the products of industry, then, is a double one — that of meeting utilitarian needs and that of satisfying a feeling for beauty.

In designing and decorating, the two purposes are interdependent. In meeting this twofold purpose, when we begin to consider any particular product, it is soon evident that the two aspects are very vitally related. When we attempt to design a chair that will be both useful and beautiful, we find that we go from one purpose to the other, modifying from one point of view to suit the needs of the other. An element of beauty is thought of as possible. But, if employed, will it weaken the chair? With the material we are using, is the form of construction which this element of beauty would require practicable? On the other hand, a certain element of form or strength for the use to be made of the chair is regarded as necessary. How can this be incorporated in the chair and yet make the result conform to the principles of harmony? Must some sacrifice in beauty be made? And so, in the development of the design of the chair, the thought and planning shift from one element to the other so that in achieving all that is desired for the one purpose no serious sacrifice is made relative to the other. This consideration of both factors will be included in designing a house, a rug, a garment, an automobile, or any other product, whatever the use or the material. In designing and decorating, any marked neglect of either element endangers the success of the product for giving entire satisfaction.

Differences in the materials of industry as to their qualities for taking on various forms, as to their variations in strength, and as to their qualities of surface appearance and treatment, make it necessary to consider these respective qualities as they relate to both use and beauty in designing. A gate made of iron designed in exactly the same form and proportions as a gate of wood for the same place would be so heavy that its use would be impracticable. Some forms of parlor chairs could be made of concrete, but they would be too heavy to move about. Candlesticks could be made wholly of wood, but the menace of fire from them makes them inappropriate, no matter how well they lend themselves to beauty of form and color. Utensils for food could be made in great variety and beauty of form with wood as the material, but they would be so quickly destroyed by the effects of moisture and temperature that their use would be impracticable for most purposes. By compromising, we may often use a combination of materials, utilizing the peculiar beauty of one which could not effectively be used alone, as when we make a candlestick with a body of wood and furnish it with a metal cap to avoid its injury by fire, or in the making of many objects of iron or steel with finish or trim of some softer, more expensive metal as nickel or silver.

Each material has qualities which limit its usage in certain ways. Each material also has qualities which make certain forms of treatment appropriate to it. Some of these forms will not apply to other materials. Clay and cement have limitations which make them quite impossible for certain uses entirely appropriate for wood and iron. Textiles have uses and are adapted to certain forms of design and decoration not possible for wood, metal, clay, or concrete. That the utilitarian purpose and the art purpose must be worked out together, with definite relationship to the qualities of the materials used and with reference to each other, is a fact which the study of the industrial arts should early impress through many experiences and illustrations.

The relationships as observed in products. It may help to intensify the close relationship of the two elements, the industrial arts and the fine arts, to separate them by a brief, outline analysis. One may think of the problem from the standpoint of either the designer or the purchaser. For the designer, the problem would be that of thinking out the forms to meet the demands of excellence required; for the purchaser, it would be an examination of the product to determine to what degree the qualities of excellence had been included. In following through the outline given, one may think of its concrete application to a chair, a hat, a pair of shoes, a necktie, a suit, a sugar bowl, or any other object in which he has an interest. This will help to test its meaning and validity.

Elements of Utility and Beauty in a Product

A. The industrial arts element with utility as its purpose. Excellence and desirability are determined by:

1. Appropriateness to purpose as to conditions, seasons, and occasions.
    - *a.* In materials — Are they suitable?
    - *b.* In form — Is it well adapted?
    - *c.* In construction — Is it sufficiently strong and durable?
2. Economy in cost — Is it unnecessarily expensive?

B. The fine arts element with beauty as its purpose. Excellence and desirability are determined by:

1. Appropriateness to purpose.
    - *a.* As to use in itself relative to:
        - (1) Materials — Are they suitable and appealing?
        - (2) Form and color — Are they pleasing and harmonious in composition?
        - (3) Fineness of construction and finish — Is the workmanship of fine quality?
    - *b.* As to surroundings — Is it in harmony with the other elements of the composition of which it is to be a part?

Appropriateness to purpose is the most fundamental and inclusive quality in determining the excellence of a product from the point of view of both utility and beauty. Anything not adapted to the purpose which it is made to serve loses some of the beauty it might possess because of its harmony of form or color when viewed without any reference to its use. A party dress, most satisfying and attractive when worn to a party, does not seem at all fitting when worn as a work dress or a traveling dress. A gown, beautiful in itself and adapted to a stout figure, would quite lose its beauty of line and proportion if placed upon one of slender build. Neckties should be selected with reference to the wearer and his other garments, and not alone on the basis of their individual harmonies of design. The most beautiful camp chair would seem very much out of place in a parlor. A fine oriental rug placed in a kitchen would lose much of its appeal to our appreciation in the feeling we would have as to the inappropriateness of its placing. Whatever is sincerely, genuinely beautiful as an industrial product must be so well adapted to its purpose that in its use for that purpose there is no thought or feeling of inappropriateness aroused. If such a thought or feeling is aroused, a sense of insincerity and sham may become so prominent as to cause one to feel dissatisfaction and annoyance rather than satisfaction and pleasure.

In designing, a design for a product must be one which can be used — which will work — or it is not a good design. It may not violate the abstract principles of harmony as to form and color, but if it cannot be used in construction it is really not a design at all, but only a pleasing arrangement of lines, tones, and colors. In an abstract sense, such a product in form and color may be called a design, but it has, in this case, no relationship to construction in the sense that it is a working plan. There can be no essential opposition between the fine and the industrial arts elements in the product that is in every way most satisfactory.

In general, it is true that materials and forms of construction that are of fine but simple quality are more durable than forms that are more complex. With good materials and simple lines, harmonies of form and color are accomplished with little need for detailed adornment, because of the strength, dignity, and natural beauty of fine materials. Simplicity adds to the feeling of sincerity and restful satisfaction, while complexity or great variety in detail arouses suspicion and a feeling of confusion. But, no matter how fine the materials nor how simple the design, the laws of harmony for form and color must not be violated, or the product will not be as beautiful as it might be. A gown of the finest material might be made to fit so poorly that its lines would arouse feelings of pity or disgust. Its colors might be so hopelessly out of harmony that it would irritate and annoy. Buildings, furniture, rugs — anything — may be made of the most durable and attractive materials, yet be literally ugly because, in their design, the principles of harmony have been violated.

This close relationship of the fine and the industrial arts indicates that the two cannot be kept apart in teaching without danger of great loss when we are considering the problem from the point of view of the consumer or user of products. In the selection of products, one must consider both phases, and neither can be adequately considered without reference to the other. The two phases are aspects of a common problem. They should be so taught in the elementary school.

Phases of fine art not related to industrial arts. Fine art includes fields not at all related directly to the industrial arts. Painting and sculpture are forms of art by which fine or great thoughts and feelings are expressed by artists. The products of artists in painting and sculpture are messages to appeal to the mind and heart of those who observe their works. In giving expression to their thoughts and feelings by the use of drawings or paintings, and by modeling in clay, carving in wood, marble, and ivory, or casting in metals, the artists use the same principles of design as those which are used in beautifying the products of industry. The principles of design are universal — they are employed wherever the problem includes the shaping or coloring of the surfaces or forms of materials to make them pleasing in their appeal.

The study of design as it applies to painting and sculpture should be provided apart from the study of the industrial applications of design. However, much that is gained in the study of the principles as illustrated in one field will help one to make their application or to interpret them in the other.

In the study of the industries, there are many masterpieces in painting, and a number in sculpture, that may be of much use in interpreting certain meanings of life expressed by artists as they have idealized the worker or his work, or as they have used the workers or their work as symbols of human or divine purposes. Some of these masterpieces are also useful for the historic detail of industrial work which they include. In some industries, no descriptions or examples of certain early processes or products remain, and we derive help from work in pictorial or plastic art which has endured long after the objects portrayed have ceased to exist. Where descriptions do exist, paintings or forms in relief often help to interpret them with an accuracy not possible from the descriptions themselves.

That there are so many paintings and works of sculpture which relate to the industrial activities of man is evidence of the place industry has had in the lives of peoples in all historic ages. The enduring work of the artist grows out of the large interests of the people of his time. The artist interprets their struggles for the meanings of life, their ambitions, their longings, their sufferings, and their triumphs. Many of the masterpieces of art show that the subjugation and control of the material world, making it increasingly minister to man's needs, has been a means to the higher spiritual growth of man from a past as remote as the beginnings of history.

Teaching selective judgment and appreciation of the beautiful. In foregoing pages, it has been stated and restated that, for most of us, the large, personal problems related to industrial products are those of selection and use. Few of us make clothing, but all wear it and have the problem of selecting it. Few make furniture or rugs or dishes, but we all use these, and most of us have some opportunities for choice with reference to them. Our problem is not that of creatively designing the forms of materials we shall use, but in judging which of those offered for our choice we shall select. The duty which this situation imposes upon the elementary school is, therefore, to develop a basis of judgment through a knowledge of art principles as these apply to industrial products, and to cultivate as much as possible a liking for those products which are most beautiful.

The designing of objects to be made. Children should design, or have a large part in designing, every object which they make. This is one means of developing judgment and taste. In working out the designs for the products made in each respective industrial field, the detailed principles of design as these are called for may be taken up with increasing degrees of complexity as ability develops. Beginnings will have to be simple, but through them knowledge and judgment will grow. Provision for choice will have to be extensive, and the opportunities for making mistakes will furnish the necessary basis for constructive criticism and help. There can be no growth of judgment except by participation in judging. The comparisons of efforts and judgments made by a class working together are excellent opportunities for developing power of judgment if these are well directed by the teacher.

This work in designing should give opportunity for the freest kind of self-expression within the limits of definite purposes. For this, the use of finished products for reference will be of great help. It is perhaps not too much to say that these are really essential. Excellent pieces of similar work bring to the children standards with which to compare their own work. They also offer suggestions which help to stimulate creative efforts if they are used in variety and attention is called to the elements that give them originality. One may use some of these elements in developing one's own original thought. To do this he should not copy another product, but he may receive one or more suggestions of detail which he can incorporate, perhaps combining elements from several different examples observed. If he is designing a chair, he will be interested in studying many chairs. His mind-set is now just right for noting details of excellence in chair designing. Much may be done to familiarize him with chair designs of different periods and of the prevailing forms of the present. From the observations made, he not only secures much help in making his own design, but he is also furnished with experiences which help ever afterward in considering chairs, either in the matter of selection and purchase, or in observing and enjoying the design in chairs wherever seen. He brings something to his observation of chairs which, without these experiences, he would perhaps never have possessed.

If a bowl in Greek design is to be made in connection with a study of Greek history or literature, designs that are characteristically Greek will become objects of interest, and these should be used to give a rich mental content as a background for the particular design. The problem will be the same in kind if the basic motif is with any other people or period. The more good examples observed of the design under consideration, the greater the value of the work, both as a stimulus and guide to creative work and as a basis for selection and the cultivation of taste.

Whatever the object of design, numerous good examples in considerable variety should be used for study. Of course, in creative work, standards emphasized in examples of products used for comparison should not be so far beyond the capacity of the children as to discourage them. In the use of superior products as models, simplicity, always adapted to the children's capacity, should be kept in mind, whatever the field of creative effort.

Developing judgment and appreciation by selection. The other means of developing judgment and cultivating appreciation lies in making selections with reference to definite purposes quite apart from designing. For most of us, this is the usual life situation. We go to shops or stores to find what is offered that seems to fit our needs and select that which appeals to us most. It may be a hat, a dress or suit, a necktie, a table, a bedroom set, a set of silverware, a set of dishes, a vase for flowers, a clock for the mantel, a phonograph, a window shade, a wall paper, or any other industrial product. Whatever the form of the purchase, our problem is one of choice. Our judgment, of course, is often complex as a whole, for it may include questions of health, utility, and economy as well as beauty. But, for our purpose in developing intelligence and taste in design, we may eliminate all considerations for the moment except that of the qualities of beauty of the particular product for the definitely indicated purpose and place. From a variety of examples in various forms and colors we may judge of the qualities of each with reference to the standards we have in mind. By comparison, criticism, and the definite application of specific principles, we increasingly become more fully conscious of these principles and we thereby increase the accuracy of our judgments. In time we may become able to judge with much success the degree of excellence in design of each of those forms of industrial products in which we have had experience in criticizing and selecting. That our judging may be as broad in its range as our needs, we should provide for experiences in judging as varied as our needs, leaving nothing to chance.

While this development of selective judgment is taking place, the cultivation of taste will be accomplished to quite a degree. The analysis required in comparing products to determine in what respects one is more satisfactory than another, or why one is in good design, another poor, will tend to influence one's liking for that which is the better. By selecting many good examples, the repetition also tends to lead to the appreciation of the best. A genuine liking on the part of the teacher for that which is good, expressed simply and sincerely but without extravagance, will influence children in some degree by contagion. Children cannot be forced to change their likes and dislikes, but most of them can be gradually influenced by much experience with the beautiful, and by association with those who love the beautiful; to lift the quality of their appreciation to more desirable levels. Judgment is a matter of intellect, but appreciation includes both intellect and feeling. In this form of study we are influencing both to some degree.

Where to find examples in the study of design. While schools can rarely have extensive collections of products illustrating good design, and while few communities have museum collections, yet in every neighborhood there are possibilities for securing much helpful material. For textile design and garment design, there are the clothes worn by the children and others in the community, and there are the fabrics and clothing for sale in stores. By asking children to bring to school samples of textile materials from scrap bags at home, a collection of classified textile designs could soon be accumulated for study and reference. The household furniture, rugs, and other products of the homes, of special interest, can and should be used. Stores and shops will usually be willing to permit visits to consider the design of commodities which they have for sale. By using the resources of the community in architecture, furnishings, clothing, and other industrial products, many fine examples of design may be found which will serve a most helpful purpose in stimulating interest, developing judgment, and cultivating taste. Many families have heirlooms that are of interest and value as pieces of fine design, and such families are usually glad to permit children to study them.

Another source of inexpensive material lies in the advertising pages of magazines and in illustrated catalogues of industrial products. Many pictures may be collected and used, showing current designs in products, and these may be compared with standards for judging their qualities. A small collection of books devoted to special phases of industrial design may also be made at moderate cost. The illustrations in these will be helpful. Examples of fine design from historic periods and from various peoples should be available through pictures when models cannot be seen, as many of these show excellent qualities which are readily appreciated when the mind is ready for them. Richness and variety in good examples of design are very desirable to stimulate interest and to indicate the wealth of possibility for pleasing variety in design of high quality. Among those who have had no opportunity for education in design, it is found that many take interest and find satisfaction in the tawdry, garish, and over-ornate. These may be most readily lifted to a higher plane of appreciation by experiences in observing and considering the elements of beauty in many examples of products whose appeal is compelling, yet whose design is simple, dignified, and restful. Comparison of two examples, one poor, the other good, analyzing them to find, one by one, the qualities which differentiate them, will be helpful in bringing out the finer, more genuine, and more lasting features of the good.

In such studies, tact and sympathy are necessary on the part of the teacher. The child's admiration for the highly ornate or artificial must not be ridiculed. Pointing out that the simpler, more dignified forms of design are more easily kept clean and that it is less difficult to provide other objects which will fit harmoniously with them will be among reasons for choosing the better, which are readily understood. The appreciative attitude must in no way be diminished, but must be so directed that interest will gradually change from the poor to the better. By emphasizing the selection of that which is finest and best, the transition in interest and taste may go forward without offense to the child's sensibilities. By calling attention to the application of the fundamental principles of design as they are seen in the great variety of industrial products, they will gradually come to be operative as the bases for judging and selecting in every situation calling for choice among products. As refined qualities in design are recognized, they bring enjoyment of an order which we believe to be higher than that elicited by objects that are crude or poor in their art qualities.

Wherever museums and collections exist, the fullest possible use should be made of them. There have been a number of periods in the world's history in which very fine contributions to design have been made. The examples of such work are of great value in stimulating interest and developing standards. Churches, libraries, and other community buildings often offer much in their own designs and decorative features to help in the development of standards and the cultivation of taste. Excursions should be made to any possible source in the community that will yield illustrations of good design related to any school problem in construction, selection, or the enjoyment of beauty as created by man. The beauty of nature should also be utilized in its fullness for cultivating an interest in the beautiful and a love of it, and the frequent use of nature motifs in the work of artists should be noted.

Tests of the art outcomes of industrial studies. The most basic test of the value of the study of design as related to industry is found in the degree in which ability is developed to choose and enjoy material products which are beautiful in themselves and harmonious with their surroundings. If design in relationship to clothing has been so studied that one dresses in good taste as to both form and color of fabrics and garments; if design of household furnishings has been so studied that one will select various articles for the household in good design and appropriately adapted to their surroundings; and if design in relationship to other industrial products has been so studied that one's choice among these is always good, then the study has served its purpose well. To develop ability to recognize that which is in good design and so to like it that we choose it when we have opportunity to select, is the specific purpose for which the work is offered.

By the method employed, large opportunity for self-expression is provided. The work will tend to develop in each child interest in creative design in about the degree in which he has capacity for it. For those who desire to design and produce their own products, or those who have ability and inclination to become designers, as such, the work will offer a good beginning. But extensive training definitely specialized is necessary for efficient, creative designing. The elementary school makes no attempt to give such intensive training. Its purpose is achieved when it develops as much as possible the capacity to select and enjoy that which is beautiful.

CHAPTER V

INDUSTRIAL ARTS AS RELATED TO OTHER SUBJECTS

The origin of school subjects in practical needs. Most school subjects had their origin in practical needs. However, the practical activities of daily life are not broken up into arithmetic, geography, history, and other divisions of material as organized into school subjects. In the experiences of life there are needs for measurement of quantities and values calling for the use of the facts and processes of arithmetic; and there are needs for a knowledge of earth controls, sources of production, trade routes, and travel routes related to one's environment and problems calling for subject matter from geography. We have taken the number and measurement aspects of experience and organized them into the subject called arithmetic; the aspects of experience relating to earth controls and place relationships we have organized into geography; and so on. Each prominent aspect of life is organized into a subject of study.

Unfortunately, the individual facts and processes of these respective aspects of life have been so brought together to make subjects of study that they have become separated from the situations in which they are needed and for which they are of use. Although the facts and processes of the several subjects had their origin in the practical affairs of daily life, and have their only usage or application in such affairs, their separation from life has become so nearly complete that children have failed to see that in-school experience and out-of-school experience have any connection or relationship. It is very largely because of this want of connection that school experience has made so little desirable difference in the behavior of pupils outside of school and in after life.

The introduction of the industrial arts, representative of so many of the practical activities and problems of daily life, offers a means of bringing most of the other subjects of study into a close and vital connection with the situations in which their subject matter is directly usable. Some of the more direct relationships, important in everyday life, are indicated in the following sections.

Arithmetic. Apart from mere counting, recognizing numbers, and arranging objects in a numerical sequence, a very large proportion of all of our daily usage of arithmetic is in the measurement and computation of the quantities and values of the materials included in our uses of industrial products and in the study of the industries. Measurements of length, area, volume, or weight are required in practically every constructive problem. In considering the economic aspects of production, the purchase and use of materials and commodities, units of value for the respective units of measure are also used almost continuously. In food problems, clothing problems, and the problems of furnishings of all kinds, arise the situations which require the use of the fundamental facts and processes of arithmetic. These problems in measurement and economy not only provide motive for taking up the usable parts of arithmetic, but they also provide the opportunities for learning how to use the facts and processes of arithmetic as tools for solving the daily problems of life.

Nearly all of the common phases of denominate numbers are called for by the needs for measurements in the industrial studies. Linear measure is required in work in clothing, shelter, and paper or book-making materials; square measure in problems in floor and wall covering, and in painting; quantities by weight and by dry and liquid measure in food studies; percentage in problems of gain or loss by quantity purchasing or by purchasing by different methods; and a knowledge of the reading of meters and figuring items of cost in lighting the home, in the water supply, and in fuel consumption for heating and cooking. These examples are illustrative of the common forms of approach to arithmetic found in the study of the industries. The use of the ruler and yard stick or tape line and the units for dry and liquid measure and for weight are of almost daily necessity in the study of the industries in school and of life outside of school.

When the need of new facts and processes in arithmetic arises in real situations, these should be used as the motive for learning these new facts and processes as rapidly as the growing capacities of children will permit. After the need has been found and met in the industrial arts problem or in some other genuine problem, then in the arithmetic work such further development and practice should be given as will make the new material the permanent possession of the pupils. The use of the facts and operations is found in practical situations, but practice in the arithmetic work, as such, is necessary to master the processes themselves.

Geography. Problems relative to the sources of supplies, the centers of production and manufacture of commodities, the markets of surplus products, and the trade routes for commodities, all lead directly to the subject matter of industrial and commercial geography. These problems, arising in the study of the industries, should be a means of initiating many studies in geography where the conditions and controls of minerals, metals, soils, climate, sources of power, labor, and facilities for transportation may be considered in detail.

These studies in geography, approached through problems in the industrial arts which call for such information, will help to explain many of the facts and conditions found in industry. Taking up questions of geography which arise in the study of the industries will in turn give meaning and worth to the study of geography itself. No phase of work in industrial arts will be more fruitful in developing an appreciation of the interdependence of peoples than the related work in industrial and commercial geography, when the two lines of work are properly coördinated. The economic basis for an international league will be clearly apparent. The peoples who help to provide us with our material supplies and who, in turn, are helped by the surplus which we produce are found in all parts of the wide world.

History. The study of the beginnings and changes in means of providing industrial products relates the work directly to history. Many of the present-day methods of industry can best be explained by finding out the simple methods of early days and following the development through the changes by discoveries and inventions which have resulted in our more complex methods. By studying the simple methods of spinning, weaving, and garment-making from primitive beginnings up through the changes in spinning, weaving, and sewing implements and machines, the methods of factory production of fabrics and garments of the present may be much more readily understood.

If these changing methods are studied in their historical settings, the industrial and social results of progressive changes may be appreciated, and the life conditions and problems of the people using the respective methods may be understood more fully. A study of the clothing problems of primitive peoples, of the Hebrews, of the Greeks and Romans, of the American colonists, and of Western Europeans and Americans after the Industrial Revolution, will make the importance and value of the inventions in textile machinery and methods apparent in a way that would not be possible without the historical settings. Many important social changes have resulted from the discoveries and inventions in industry. The progress of the race from the poverty of primitive life to the wealth of the civilized peoples of to-day has been determined by the changes in industrial production to a degree seldom appreciated.

Work in history for all of the grades of the elementary school above the first is coming to be increasingly common. Where such work exists, the relationship to the industrial arts is very close. Many of the problems of earliest peoples most readily understood by children and of interest to them are those of their activities in providing themselves with material supplies. In such courses, many units of work in history and industrial arts may be treated together as but two aspects of one line of work. Where no such courses in history exist, the historical material of industry may well be included as a part of the industrial arts work. In the graded courses of study in the later chapters of this book, many suggestions are made for using the historical material related to the study of the industries. The use of this historical material adds breadth of interest and meaning to the study of the industries, bringing out values of significant worth in the development of intelligent and efficient consumers and citizens.

Language and literature. The necessity for finding answers to questions by investigations, experiments, excursions, and readings from numerous sources and reporting findings, gives need for much expression in both oral and written form. Letters of inquiry and of acknowledgment are often required. Rapid silent reading is necessary. Digests or summaries in outline form are needed. Clearness of description and exposition is a factor which must be emphasized for rapid and efficient work. Habits of using all kinds of reference material must be developed for efficiency in the work. Vocabularies are extensively widened by the investigations, readings, and reports. All ordinary forms of composition are inherently required or stimulated in the study. The courses in language may both utilize much of the content of the industrial studies for their development, and also contribute much in improving the quality of language used in the oral and written expression required by the industrial arts.

Literature furnishes many excellent references for illuminating the relationships of industrial life to human purposes and values. Vivid portrayals of industrial situations and conditions are found in many good books of fiction. Stories and poems abound in which the work of the industrial producer is presented in terms of its significance, and in forms that appeal to our sense of the dignity and worth of the industrial worker. These forms of literature closely relating to definite phases of industry should be used at the time when they will mean most. An industrial arts study often furnishes the background for the understanding and appreciation of a literary selection. Much historical literature is relatively meaningless until the background for its interpretation is provided. Longfellow's "Keramos" is much more meaningful and appealing when read as an artistic treatment following a study of the making of pottery; "Fust and His Friends," by Browning, is a very fitting poem to read after a project in wood-block printing and a study of the invention of printing by movable type. Here, as in other subjects, the literature both illuminates the industrial arts work and is itself made more meaningful and appealing by the industrial studies.

Hygiene and physical education. The health values of the industrial arts studies are so much emphasized throughout the proper study of foods, clothing, and shelter that the work rather fully covers many of the problems of hygiene. Many also of the problems of personal hygiene and physical development not included directly in studies of the industrial arts relate closely to these studies. Whenever the connection is close, it is an economy of time and effort to use each to help the other. Many folk songs, games, and plays are but joyous, artistic forms of expression for the characteristic qualities and meanings of work The study of the industries gives the background for the interpretation and most meaningful expression of these.

Fine arts. The place of design in the study of the industries is so vital and direct that Chapter IV as a whole is given to it. These two phases of production and selection are so interdependent that they cannot be separated for study without great loss to both in the elementary school.

Limitations of departmental teaching in the elementary school. Because of the marked relationships of the several subjects of study, it is very artificial and wasteful to separate each entirely from the others in teaching. Where each subject is taught by a teacher who does not teach the other subjects related to it, it is difficult to make use of the elements of two or more subjects as these elements are parts of a common problem. If one teacher has the industrial arts, another the arithmetic, and another geography, there is danger either of much overlapping and duplication of work, or of neglecting important relationships. If still another teacher has the English, the material about which the children really have something to speak and write can be of relatively little use as opportunity for the improvement of expression. Under such conditions, the English is almost sure to be unprofitably formal and artificial. On the other hand, if all of the related subjects are taught by one teacher, the different subjects may be drawn upon to make their respective contributions to the common problems to which they relate. This may be done without the waste of duplication or neglect. The one teacher can see just where each subject is needed and how to use its contribution at exactly the right place and time.

The industrial arts work makes so many demands upon arithmetic, geography, history, and English, and likewise contributes so much in furnishing motives and problems for these subjects, that the teaching of all of these by the same teacher in a given grade is essential for the most effective and economical work. The teaching of each is made more easy and effective by the use of the others.

In the elementary school, therefore, the departmental form of instruction would seem to be far less efficient than the plan of having all of the related work taught by one teacher. The problem method can hardly be used at all in any natural sense of the term under a departmental plan, since life problems do not classify naturally on the basis of the school subjects as organized. Because of its very extensive relationships, industrial arts, of all subjects, should not be taught by a special teacher. It is not a special subject in the sense of being unrelated to other subjects, but, quite the contrary, it is rather the most general subject of all in its far-reaching relationships.

The unity of life and school experience Life itself, as it has been noted in the foregoing section, is not broken up into subjects, each separated formally from the others. Daily problems have their various aspects—they involve practical activities, the use of number, of geography, of history, of fine art, of English, and of the coöperation of numerous people. All of these aspects appear in an almost infinite variety of combinations, and we are scarcely conscious of passing from one aspect to another. It is possible and desirable to bring much of this unity of life into the school. By so doing, the school work becomes more nearly a genuine practice of life activities themselves. There is, of course, need for taking up many units of work in each subject for mastery of its specific parts. But if these are taken up as a result of a sense of their need and worth as revealed in problems which require them, they have a meaning and make an appeal that counts for much in reducing the time required for learning them. They enter into experience in school as they are used in experience outside of school. No other phase of school work has such great possibilities for bringing about this unity of school and life experience as the industrial arts when taught with proper regard to the broad relationships of its problems and its content.

PART II

APPLICATION OF PRINCIPLES IN SUGGESTED STUDIES

CHAPTER VI

THE ORGANIZATION AND USE OF WORK FOR THE RESPECTIVE GRADES

The sequence of units. The six chapters following are devoted to a series of suggestive activities for each of the six fields of industrial arts for the elementary school. The term *suggestive* is used to indicate that no attempt is made to offer a complete or arbitrary course of work. The principles of foregoing chapters are here applied. By building up a course of indicated and supplementary work, the teacher will grow into its larger spirit and meaning.

While the organization here made has been on the basis of natural relationships, viewing the problem from general considerations, any other sequence of fields or units which seems best for a given school or class will not violate the purpose of arrangement intended for the work. Teachers should use their individual judgment in determining the order of the units to meet the needs of their own classes.

Cross references. Very often the work in one chapter supplements that of another. The teacher should keep well in mind the work of each field for her own children so that these connections may be made and all related material in the book utilized when it will be most meaningful and valuable. The chapter on tools and machines furnishes content that relates to work in every grade in nearly every other field. Tools and machines are of most significance when considered in relationship to the work which they do.

Supplementary sources of problems and materials. For each field a brief, selective bibliography is included. Most of the books listed are relatively inexpensive, and are written in language so simple that children can read them with interest and profit when they go to them with specific purposes. A few books listed are of value chiefly for teachers. All books listed are briefly described as to content and character, and teachers will usually be able from the descriptions to select from the lists with satisfaction.

The use of the environment through visits or excursions, either by classes as wholes or by individuals or groups outside of school hours, is sufficiently suggested in definite problems throughout the book to require no general statement here other than that of emphasizing its importance. Above all things, work in this field must not be isolated from the life problems and activities of the community.

Occasional suggestions are given for writing to manufacturers and other producers for illustrative materials. There are many other possibilities of this kind not definitely suggested. By consulting the advertising pages of the better magazines of large circulation, and those devoted to particular fields, one may secure much good material and many suggestions for writing letters of inquiry on subjects for which further information is needed. Often exhibits of materials and processes, or printed matter well illustrated, is sent out gladly by manufacturers. Exchanging materials and letters of informational character with children in schools in other parts of the country will often prove valuable. Writing courteous letters of inquiry, acknowledgment, and thanks by the children will offer excellent motive for some work in letter forms. Keep informed about what is available from the office of the Superintendent of Documents of the Government Printing Office at Washington, D. C., and from the various state departments and bureaus of your own state. Much material may be secured free or at very small cost.

For materials needed in the work which it is necessary to buy, consult local dealers, and consult also the advertising pages of the Industrial Arts Magazine, published at Milwaukee, Wisconsin; the Industrial Education Magazine, published at Peoria, Illinois; or the School Arts Magazine, published at Boston, Massachusetts. These will usually carry the addresses and descriptions of goods of a number of supply houses for standard school materials. Some exact addresses are given in this book for certain materials relatively hard to secure.

Equipment. For each school building, it is desirable to have one room equipped with the necessary furnishings and tools for the work of all of the first six grades. Much of the work can be done in most fields in the regular grade room. But it is worth while to have one room to which any grade may go when the work requires it, especially adapted to these needs. For such a room, there should be several tables of different heights, several work benches also of different heights, the common hand tools for work in wood, a sewing machine, a gas or oil stove with an oven, a few cooking utensils and dishes, a zinc-lined cupboard for clay work, a soldering outfit, an abundance of closet space for small tools and materials, and cupboards or drawers for paper in large sheets as well as small. A considerable amount of locker space is desirable for unfinished work. Such a room might be gradually supplied with tools and devices as needed, thus avoiding the expense of purchasing equipment not needed. Schools will vary in work undertaken and correspondingly in needs for equipment beyond the few essential tables, benches, and tools common to the needs of all.

Supplies. By looking carefully through the work and estimating what constructive activities would probably be undertaken during the year, teachers could determine about what supplies should be secured in advance so that work would not be delayed. When materials can be procured in the community without delay, it is worth while to have the children participate in the planning, selecting, and buying of these for each respective purpose. It will be noted that in many cases, the constructive problems are for illustrative or demonstrative purposes, and that each child does not make an individual product. This form of work requires much less material than constructions more or less alike for all of the children of a grade. Children can contribute much material from home for some kinds of work. Discarded materials frequently serve the purposes as well as new, expensive materials. Friendly relationships with storekeepers will often yield much material that would otherwise be wasted.

Approach to the work in the primary grades. Children enter school with a background of experience rather limited in its scope. Usually the first-grade children have spent most of their time with the mother as she is engaged in meeting her home-making responsibilities. They have seen her mending the worn garments or making new ones, and preparing the family meals or washing the dishes. They have gone with her to the grocery stores and have watched her selecting food for the family, or to the dry goods stores to buy linen or muslin or clothing. They have heard the father talk of what he does when he goes away each day or have observed him at his work. This capital to use in their school work is largely the first-hand experience with the work of the mother and father in keeping the family supplied with the things needed for comfort. Their range of experience is relatively narrow. They know the grocery boy, the postman, perhaps the milkman. Those who have immediate contact with their home, those whom they actually see, constitute their world. It is with this limited world that the school should begin.

For leading these children into a richer, fuller notion of some of the fundamentals of living, we can utilize many of the tendencies within them which are impelling them to action. They like to handle things; they are curious to do things and see what happens; they like to talk about their experiences; they cannot refrain from asking questions; and they still play with dolls, build houses, and play store. These tendencies are valuable because they can be utilized in enlarging their experience.

Right selection of activities and proper guidance of them so that the children may become aware of difficulties, or so interested in what they are doing that they begin to investigate, to ask more questions, to experiment, should develop notions of family and community interdependence and coöperation. Using the tendencies to action and inquiry, the work in this industrial-social study would then begin by dressing dolls, making and furnishing a doll house, and visiting stores. Through following up the questions arising, through comparing the ways in which the various processes may be done, through discussion of the varied ways in which the children may have seen these situations met in their homes, their ideas of home activity and family interdependence may be greatly modified and enlarged. The work will carry on to questions as to the source of supplies for the home, and will gradually show the dependence of the home upon those outside the home. The milkman, the grocer, the baker, the newsboy, the postman, and others become the means of connection with the community. Following these considerations will naturally come the supplying of community needs for water, light, fuel, police and fire protection, streets, library, and schools.

Through the first three grades, the study of these community and family relationships carries the children into questions which become very complex. The time is reached early in the period when it seems desirable to use the accounts of how these needs are met or have been met by simpler forms of society. The needs are much the same, and many of the fundamental means of meeting them are the same, yet in simpler forms of social life the details stand out more clearly. Comparison of the simpler forms of social life with ours helps to interpret some of the complexities of the activities of our social life.

The work in the middle and upper grades. In the grades above the third, the work in industrial arts takes on a degree of detail or intensity which calls for larger considerations of fundamental processes, the limitations and possibilities of materials, and the story of the development of processes and methods from early beginnings to the forms by which our work is done to-day. Gradually through these investigations those values are brought out which are important in relationship to health, economy, and taste in living, and which should be instrumental in making for greater efficiency in social coöperation.

All through the grades, the historic and geographic relationships, the underlying scientific principles, the quantitative aspects, and the related literary or artistic interpretations of phases of industrial life will need consideration in connection with the processes studied. Through the whole progress of the work, it is desirable that it should become increasingly apparent that industrial activities are not an end in themselves, but that they are the means by which man is increasingly provided with creature comforts, added leisure, and opportunity for greater refinement of living in both his physical and spiritual experience.

CHAPTER VII

SUGGESTIONS FOR THE STUDY OF FOODS

GRADE I

Discussing mother's work in providing us with foods. In considering the work of each member of the family, mother's work in providing food stands out as very important. Time should be taken to develop quite clearly the different ways in which the many mothers do the same piece of work, thus building up a general notion of the fundamental process. Children will probably be more quick to see their dependence upon others for foods than for any other commodity. They will more readily appreciate mother's work in this field.

Of all mother's work in connection with foods, the most significant should be selected. The choice of what to discuss should always be in terms of how far-reaching are the interests a given study will arouse. If teaching in a section where standards are low and living conditions poor, the selection of what to study should be based upon a remedial standard. What do the children need to know to cause them to be better nourished?

Finding out why food is put away in the fall. In discussing what mothers are doing in the fall, mention will frequently be made of canning and jelly-making. The question can well be raised as to why mother is so eager to can so much. This will bring out the fact that much fruit is ripe then and will soon spoil if not canned. Winter soon will come when there will be no fruit ripening. Some children will report their fathers' buying potatoes and putting them away in the cellar or even burying them in the ground. Some will know of apples and onions and cabbage being put away similarly. Older brothers in some localities will be going to the woods to gather nuts. Some children will have seen corn being dried. Wheat and oats have been put in bins or granaries or hauled to elevators. Corn is being husked and hauled to cribs. Some may know of canning chickens or salting or drying fish. As full a list of these activities as possible should be made. A list of things that are canned could be charted by cutting out pictures of the things, pasting these on the chart, and putting the names underneath.

Canning tomatoes, apples, or pears. To give greater reality to the discussion, a can of tomatoes, apples, or pears may be prepared in the classroom as group work. A chafing dish or electric plate or sterno stove may be used if the room lacks a gas plate or stove. Each step of the procedure should be carefully discussed and the correct way be emphasized with simple reasons.

To can tomatoes, pour boiling water on them. Let them stand until cool enough to skin. If apples or pears are canned, wash, pare, quarter, and remove the cores. Place in a kettle with a little water and put on the stove. Bring to a good boil. Apples and pears should be cooked until slightly tender. Too much cooking will cause them to crush. While these are cooking, the fruit jar should be in a kettle of boiling water so arranged that something is under the jar to keep it from breaking. When the fruit is ready, the jar should be emptied and set upright in the water, being kept steady by a holder. Put the boiling fruit in until the jar is level full. Scald the rubber and put in place. Take the lid from the boiling water and fasten in place, being careful not to touch the inside of the lid or the fruit jar edge. Remove the jar from the water and fasten the lid securely so that no juice escapes when the jar is inverted. Canned tomatoes should be wrapped in opaque paper to keep out the light. The cold-pack process is not necessary for this work.

Making jelly. *Apple jelly.* As a substitute for canning, or in addition, a jelly can be made. Apple jelly is very easy to make if the apple is a jelly apple. Inquire as to this or try some first. Wash and quarter the apples. Cook with a little water. Strain through a cloth bag. Measure the juice. Boil down for about ten minutes. Add as much sugar as there was juice when measured. Boil until a tiny thread begins to appear as the jelly drops from the spoon. Pour into a glass. Let it cool. Melt some paraffin and pour a little over the top of the jelly.

Cranberry jelly. Just before Thanksgiving the children will be interested in making cranberry jelly. Pick over, wash, and measure the cranberries. Put in a kettle with half as much water as berries. Cook until the berries burst. Strain. Measure the juice. Boil the juice a few minutes and then add as much sugar as juice when measured. Cook until the jelly tends to hang along the edge of the spoon and then falls in heavy drops.

Making a cake. Baking day is a very interesting time to the small child. He likes to help or to make a little cake. In making clearer and larger his ideas about baking, the making of a simple cake as a class activity is worth while if the significance of the different things done is made clear. The following recipe is simple, easy, and not too rich. This amount will give a fair-sized piece to each of twelve.

There will be needed 1½ cups of flour, 2½ teaspoonfuls of baking powder, ½ cup of sugar, ¼ cup of shortening, ½ cup of milk, 1 egg, and some flavoring. Cream the shortening and add the sugar. Beat the egg and add to the mixture. Sift the flour and baking powder together. Add the flour and milk alternately, a little at a time as you stir. Add the flavoring. Put into a greased pan which has been dusted with flour. Bake. Cookies may be made instead of cake.

Preparing soup for luncheon. Some discussion of luncheons is valuable because of wrong ideas as to their purpose or content. To make the discussion more real, occasional preparation of a simple dish helps. Soup is a good dish to prepare if the children can plan for it by bringing cups from home for serving it. The canned tomatoes may be used for this purpose some cold winter day. To prepare, heat one or two cupfuls, according to the number of children. In another kettle scald a quart or more of milk, thickening it a little with flour and cold milk blended until smooth. Add salt and a small lump of butter. When the tomatoes have boiled and the milk is thickened, add soda to the tomatoes in the proportion of one-eighth teaspoon to a cup of tomatoes. This will neutralize the acid and prevent the curdling of the milk. Combine the two mixtures, cooking a few moments.

Cocoa may be used for a hot dish in connection with the luncheon discussion. The discussion should include such topics as the importance of clean hands, the growing child's need of from a pint to a quart of milk a day, the importance of eating slowly, correct table manners, the value of pleasant conversation, the need of fruit and vegetables in the diet, the need for chewing the food thoroughly, the advisability of avoiding very cold and very hot foods, and the reason for not eating between meals.

Washing dishes. After luncheon the dishes must be washed. This makes a good opportunity for talking about right methods and the reasons for them. The discussion should include the reason for washing in warm water, what the soap does, why the dishes should be rinsed in very hot water, and what is necessary in drying them. There should be mention of the fact that dishes used by those who are ill should be boiled.

Finding out where our food comes from. Through trips to the farm and to the grocery store and through questioning

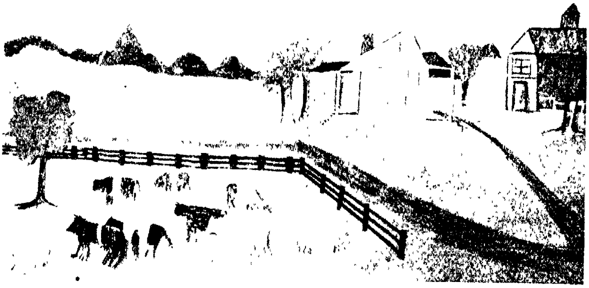

FIG. 1. A Farm

After a Speyer School class had visited a farm this representation was made.

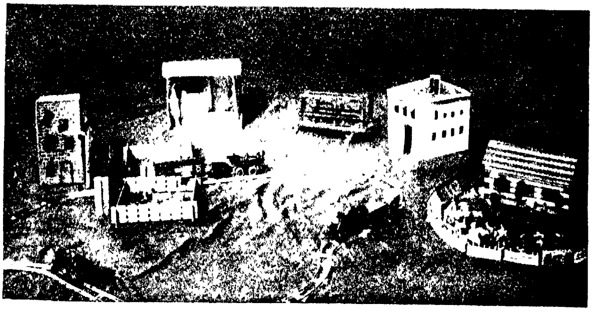

FIG. 2. A Study of the Source of Meat

older people the children can find where the important foods come from. Cut-out pictures, properly labeled, can be used to list the sources from which the foods come. These can be arranged into charts. They should include the farmer, the grocer, the baker, the miller, the fisherman, the dairyman, the meat man, and the vegetable man.

Desirable outcomes in Grade I. From this work the teacher may expect:

1. A greater appreciation of mother's work and our dependence upon her.
2. A growing conception of interdependence.
3. A more intelligent interest in family activities.
4. A clearer notion of why food is stored for winter.
5. Some understanding of what is done in canning.
6. Some understanding of what is done in making jelly.
7. A better appreciation of baking day and of what goes into a cake.
8. A better understanding of what a child ought to eat.
9. A greater willingness to eat the simple foods.
10. A knowledge of what is necessary to be done in cleaning dishes.
11. Some notion of where our food comes from and of our dependence upon other workers.

GRADE II

Following foods to their sources. Visit the grocery store. Make lists of the foods the labels of which have places printed upon them. Note all the things the merchant tells the children as to where the different foods come from. Make a collection of labels on foods, showing as great a number of different places as possible from which foods come. Do many people work for us?

Preparing a picnic lunch. Children like picnics but often have wrong ideas about what constitutes a good lunch.

The standards of leaders of boys' and girls' clubs seem to children rather too plain. An excursion of such length as to necessitate a lunch offers a good opportunity for discussing lunches for hikes and picnics. Simplicity, ease of carrying, digestibility, and proper kinds of foods are some of the characteristics to be stressed. It would be well to plan the lunch together if it can be arranged. Sandwiches are easily carried and save cutting and spreading when at the picnic. They also can contain some of the food values needed. Fruits that will carry well, such as oranges, furnish the fruit juice needed. Bacon is savory and appetizing. It can be carried easily and children delight in broiling it on sticks. Hard-boiled eggs carry easily and provide some desirable food value. They need to be very thoroughly chewed. A canteen of drinking water should be taken, as the only safe way to secure pure water. Raisins furnish

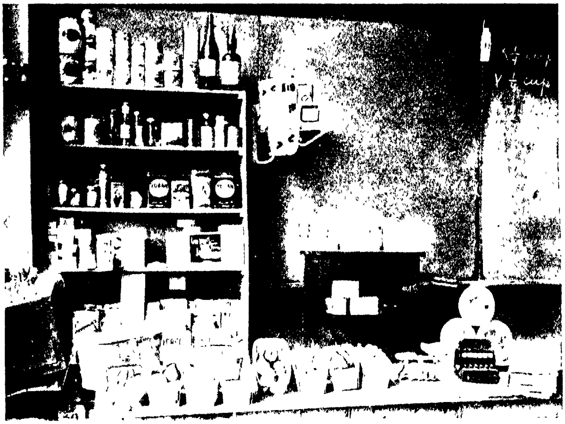

FIG. 3. A Grocery Store Made by Second Grade Children

an easily carried and wholesome sweet. Many sweets do not meet the approval of club leaders.

Finding how primitive peoples got their food. Hiking, building a fire out of doors to cook the bacon, and providing food and water in advance ought to suggest questions as to how Indians, and even more primitive peoples, found and prepared food. Enough questions should be raised to stimulate further investigation. Reading Miss Dopp's books, *The Tree Dwellers*, *The Early Cave Men*, and *The Later Cave Men*, will give some material to think about. The children's attention can be directed to parts of the stories that will lead their thinking in the right direction. The use of nuts, berries, and roots will soon become known. Call attention to the edible nuts, berries, and roots growing wild near the school. Flesh and fish were eaten raw. Water from the streams was used to drink. Notice how careful these people were to stay near a stream. Note the changes in the foods when fire was discovered — how water was boiled for cooking purposes, meat cooked, and roots roasted. Note how they learned to light a fire with flint. Find the part of the story telling how they learned to make a bow and arrow and later how they learned to use a bow drill to make a fire. Compare these methods with those of the American Indian.

Finding out how to prepare vegetables and fruits to be eaten raw. The discussion of primitive people's use of raw foods raises questions as to what we eat raw and how we should prepare it. Lists or charts of vegetables and fruits which we eat raw can be made. Some, like apples, are better eaten cooked, for children should know how wholesome for them baked apples are.

In all cases, where food is eaten raw, washing must be done very carefully. Bugs and insects are possible. Children in cities eat foods that have been picked for some time, and impure ice, or more often impure water, may have been used to keep them fresh. Thorough washing is necessary. For this purpose a vegetable brush should be in every kitchen. Children should be taught that there is a food property in green vegetables which is essential to health and growth. It is called *vitamine*. If cooked too long, the green vegetables lose this vitamine quality. The children may have known of scurvy, which sailors on the sea may get if deprived of fresh fruits and vegetables for too long a time. Oranges are rich in vitamines.

Desirable outcomes in Grade II. From this work the teacher may expect:

1. Some notion of the extent of our dependence upon the outside world for food.
2. A better understanding of what should constitute a picnic lunch.
3. Some ideas of the kinds of food a child should eat.
4. Knowledge that green vegetables are especially good for children.
5. Some idea of why vegetables should be washed clean.
6. Knowledge that orange juice and baked apples are good fruits.
7. Some notion of the conditions under which men lived long before there were stores and farms to provide food.

GRADE III

Finding out why milk is so important in the diet. Children are often allowed to follow their whims as to whether they drink milk. Then too there are parents who believe that milk is too expensive to provide it for the children to drink. A knowledge of established facts will assist in correcting these errors. A growing child should have from a pint to a quart of milk a day. Fresh milk is rich in vitamines. A quart of milk is said to be equal in food value to a pound of steak or to eight eggs. Compare the prices of each. Many parents who find milk so expensive feed the children much meat, although many dietitians state that children under eight are better off without meat. If any is eaten, it should be together with plenty of vegetables and should not exceed an ounce a day.[1] One person has stated that until the family is provided with a quart of milk for each growing child and a pint for each adult, no meat can be afforded.

Finding out what milk contains. Milk is sometimes spoken of as the perfect food because it contains water, vitamines, carbohydrates, fats, and proteins, five important food principles. Children by experiments may be led to appreciate this fact to some extent. They are familiar with the cream that comes to the top. Let some cream become sour and make it into butter. (See page 95.) Some of the butter can be melted and be shown to be fat. Put a drop of skimmed milk under the field of vision of a compound microscope, and look at the globules of fat. If cream were used, individual globules would not show, as there would be too many to be discriminated.

The sweet taste which later becomes sour suggests the carbohydrates, or starch and sugar group. The protein can be seen in making junket or cottage cheese. It is the curd.

Making junket. Buy some junket tablets at the grocery. Follow directions in making the junket. The essential thing is not to let the milk become more than lukewarm. Making junket in school may be profitable because it usually results in the children's wanting some at home. Since the milk remains uncooked during the process of preparing it, this makes an excellent dessert, retaining the vitamines it has. Further, this provides an uncooked-milk dessert which is more digestible than cooked milk. Set a small quantity aside in a cup and let it sour. This will separate the curds from the whey so that the two are clearly distinguished.

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[1] Willard, F., and Gillett, L. H. — *Dietetics for High Schools*, pp 129-30. Macmillan

Making cottage cheese. Get some clabbered milk. Put it into a kettle and pour boiling water over it. Allow it to stand for two or more hours. Strain through a sterile cloth. Salt and add some sweet cream and butter to taste.

Making butter. Put some sour cream in a glass fruit jar. Screw the lid down tight. Shake the jar until the butter "comes." Carefully remove the butter. Put it into cold water. Wash it thoroughly. Press the water out by using a spoon or paddle. This is commonly called "working" it. Add salt to taste, working it in thoroughly.

What is left in the milk from which the butter was taken? What does this buttermilk contain? Stress the fact that buttermilk has been found to be conducive to health and is often prescribed by physicians.

Finding whether or not each child is up to standard in height and weight. Write to the Child Health Organization, 370 Seventh Ave., New York City, or to the Superintendent of Documents, Washington, D. C., for material on height and weight standards for the various ages. Make a chart containing the name of each child. Place after these names double columns enough for each month and one additional for the age, in months, in September. Each month, weigh and measure each child. Record the weight and height of each. Consult the standard card and record in red ink the figures for those who are below standard.

Questions as to why some are below will lead to questions as to health habits. Among these health habits, what is eaten is very important. If properly guided, the interest can be directed toward the question of what one should eat at each meal. The Child Health Organization has a chart suggesting meals for a week. It proves an interesting investigation to put the seven breakfast menus on the blackboard and study them to find the food values to be found in each meal. In nearly every menu the children will discover fruit — prunes, oranges, or baked apple; a cereal — usually one that has been cooked a long time; a glass of milk; and some toast and butter. In these, the starch, protein, and fat should be noted. Similarly the dinners and suppers should be studied. The children will soon note the coarse green vegetables in every noon meal and will be almost certain to ask why they are needed. They should be led to recall the vitamines these contain and should be told of the service these vegetables render in furnishing roughness and porosity to the contents of the digestive tract.

From this study of menus the children should get quite definite notions of the relatively large amount of starchy foods, the relatively small amount of protein, the amount of milk, and the amount of coarse vegetables one should eat each day.

The protein is the body-building food. The carbohydrates give heat and energy. The fats also give heat and energy. An amount of fat produces more than twice as much heat and energy as an equal amount of carbohydrates, but it is sometimes difficult to digest. Spinach is valuable, not only for its green-vegetable properties, but as the best source of iron. Eggs are an easily digested source of protein, while bread and butter provide carbohydrates, protein, and fats.

Making health booklets. These studies may be summarized by having the children make health booklets, cutting pictures illustrative of health rules, mounting them, and writing the rules underneath.

Finding out what the Indians ate. From the children's reading about Indians and from inquiry of those who have known Indian customs, find out what the Indians ate and how they obtained it. Make a list of all the foods you can find that they ate. Very soon in the study of Indian foods the children will come upon the grinding of corn with a mortar and pestle. Some one in the community may have one that the children can see.

Making corn meal. Get some dry corn to grind. Various methods will be suggested for grinding it. Perhaps the method most easily managed by the children will be grinding the corn in a food chopper.

Making corn bread. Make some corn cakes, using the meal just ground. Mix with water and bake on hot stones. Compare these with some corn bread as we make it. Use quite sour milk or clabbered milk. Get some corn meal. Mix milk and corn meal with a small quantity of wheat flour to the consistency of drop batter. Add salt and a tablespoon or more of melted shortening. Dissolve the soda in a small amount of water and add to the mixture, using a level teaspoon of soda to every cup of sour milk. Pour in a greased pan and bake.

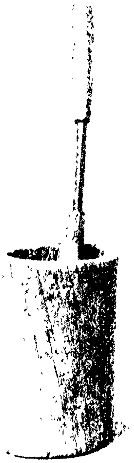
FIG. 4. One Form of Mortar and Pestle Used by the Indians

Drying some corn or apples. To appreciate the Indian food further, some corn in the roasting-ear stage, if available, may be cut off the cob and dried. Apples may be pared, quartered, and dried. The difficulty of keeping flies off will be noted and cause the children to question how the Indians kept their food clean, if at all. When dry, the apples should be put into an oven a short while to sterilize them. Why? Read from Parkman's *Oregon Trail*, Chapters 4 and 15, the description of the buffalo hunt and hanging the dried meat in the treetops.

Cooking the dried corn. Later in the winter this corn can be washed and soaked in water and then cooked. This will give some judgment of the food.

Making parched corn. Put some dry field corn in an iron skillet or in a covered iron kettle. Add some salt and butter. Parch over the fire, stirring constantly. This sort of food was carried on the trail by the Indians. They did not use butter in preparing it.

Making hominy. Put one quart of dry white field corn into two quarts of water. Add two tablespoonfuls of baking soda. Boil until the hulls come off easily. Wash in clear water. Cook the hominy in milk seasoned to taste with butter and salt; or boil in water, and season to taste. It may be eaten with or without milk. For removing the hulls lye leached from wood ashes may be used, one-half pint to a gallon of water, or prepared lye may be purchased from a store and used, one teaspoonful to a gallon of water.

Making succotash. Cook some beans and corn together. The Indians sometimes included a piece of fish or meat. This constituted a complete food, for the beans contain carbohydrates and protein, the corn carbohydrates, and the fish or meat fat and protein.

Finding out some of the characteristics of Hebrew foods. The unleavened bread, like the Indian corn cake, lacked a leavening agent. The meat laws of the Hebrews are worthy of note because of their being the expression of their attempt to eat clean meat. Find some of these laws in the Bible. Why should there be such rigid rules about the sharpness of the knife used in killing the animals? How were knives made at that time? Compare the inspection rules with our government inspection.

What fruits are mentioned in the Bible? Did the Hebrews use milk? Butter? Honey?

Desirable outcomes in Grade III. From this work the teacher may expect:

1. A knowledge of the food value of milk as compared with some other foods, and the amount a child needs.
2. Some acquaintance with the food principles and what they do for the body.
3. A better idea of what to eat.
4. An interest in health and keeping weight up to normal.
5. A better appreciation of the cleanliness, flavor, and variety of the foods we eat.
6. Some knowledge of what butter and cheese are.
7. Knowledge of how to grind grain into meal and make the meal into a bread.

GRADE IV

The work of the fourth grade in geography usually is intended to give the child a world view. One very good way to get the child to feel his connection with the whole world is to have him trace to their sources the things shipped into the community. This can be done by securing a list from the express office and one from the freight office of the things shipped in, together with the name of the place from which they came. The list may cover one or two or three weeks, as is convenient. On an outline map of the world, locate each of these things with the name of the place from which it came. Draw red lines from these places to the home town. Or, in a similar way, the things shipped out may be traced.

Finding out how raisins are made. Find the address of a raisin company by looking at the name on the carton or looking in the advertising pages of a magazine. Write to the company for printed material telling how raisins are made, their food value, and ways of using them. Consult the Readers' Guide for other articles on raisins. Find out the history of raisin growing in California. How is the sugar put into the raisin?

Finding how dates and figs are prepared. Write to a company preparing dates, asking for information about processes and food values. Do the same for figs. How are they prepared? Where do they grow? What kind of climate is suitable for their culture?

Finding the food value of nuts. Tracing nuts to their source will involve reading advertisements of nuts which will probably give some information about their food value. What edible nuts are grown in this country? What food value do nuts give to the diet? What food can one eat less of if he uses nuts? Nuts are hard to digest if not thoroughly chewed. For this reason, dietitians recommend that peanut butter be allowed for children under seven, but not nuts. The food value of peanut butter is very high.

Making a collection of different kinds of macaroni. Macaroni is an Italian dish, now much used by Americans. Find the process of making it and the amount imported from Italy. See how large a collection of different kinds the children can gather. One class found over thirty different kinds. Collect advertisements of macaroni. It is a nourishing food. What does it contain? Cheese or tomatoes may be used with macaroni. Find out how.

Finding ways of preparing eggs. Because the egg is so valuable in the diet of growing children, it is important that they know its value and ways of preparing it. Eight eggs are equal to one quart of milk in food value. The white of the egg is rich in protein. The children will be interested in testing with the protein test. Put a piece of the white of a boiled egg in a test tube containing nitric acid, and shake. It will turn a bright yellow. Do the same with some cooked rice, and again with some crisco. No such effect is seen. Dietitians advise against fried eggs because of their indigestibility. A very easily digested egg is prepared by placing in boiling water and covering just as the kettle is removed from the flame. Allow it to stand in this hot water five minutes. Prepare one thus and note how tender it is. Place an egg in cold water, bring it slowly to the boiling point and boil for eight minutes. Compare it with the other in its tenderness or lack of it. The value of uncooked eggs for invalids should be noted, as well as suggestions for attractive ways to prepare them.

Finding out how eggs are stored. Find out what you can about the laws regulating the cold storage of eggs, ways of "candling" eggs, and methods of keeping eggs at home. Investigate the use of water-glass in preserving eggs. Buy a quantity and put some eggs away in it to see how well they keep. Why should eggs need to be preserved? Visit a cold storage plant, if available, and find the temperatures at which the various foods are kept.

Testing starch. The testing of the white of egg will suggest to the children that there must be a test for starch. Put some iodine upon cooked cream of wheat and upon some bread. It will turn purple. Try it on crisco and upon the white of boiled egg. It has no effect.

Finding how we get enough carbohydrates in our diet. Books on dietetics indicate that about three-fourths of our food should be carbohydrates. They furnish fuel to the body for work and warmth. We get them chiefly in the cereals, sugars, fruits, and vegetables we eat. The sugars are likely to cause trouble if taken in excess or in concentrated form. Make a list of all the foods you can identify as containing carbohydrates. A good thing to remember is the fact that it is better to get our carbohydrates from vegetables and fruits than from sugars.

Finding out how long cereals should be cooked. This study of cooking raises the question of how long cereals should be cooked. It is quite generally agreed that the best cereals for children are oatmeal made of the oat grain cut very fine, corn meal, or wheat meal, boiled in a double boiler three hours to explode the starch granules completely. Cut advertisements from the magazines and write to cereal factories, and see what information can be obtained relative to the various cereals.

Cooking starch. Starch is usually the main source of energy. To see the presence of starch, grate some raw potato. Put it into a piece of cheesecloth and wash thoroughly in a bowl of cold water. A fibrous material, called cellulose, will be left in the cloth. The starch will settle to the bottom as a white material. Put a very small amount under a microscope, and see whether you can distinguish the granules. Find out how starch foods should be cooked. The essential thing is to boil them long enough to explode the granules. Put some cooked starch — white sauce or potatoes — under the microscope. Compare with the uncooked. Vegetables are composed largely of water, starch, and cellulose. The cellulose is not digested, so far as science has been able to determine, but is valuable in that it furnishes bulk to the digestive content, thus stimulating the intestines to greater effort in their work of elimination.

Explain why baked potato is considered so valuable in a child's meal.

Preparing vegetables. Because coarse vegetables are so important to the diet and because they are believed to lose their vitamines if cooked too long, and further because these foods are not attractive to many children, it is very important that they be cooked properly. One way, satisfactory to many, is to prepare them by boiling quickly and then dressing them with white sauce.

Making white sauce. Because some children are not acquainted with vegetables served in this way, it will be well to teach the way white sauce is made. For each cup of milk use one level tablespoon of flour. Blend the flour with a little cold milk. Heat the rest of the milk, add a lump of butter, and salt to taste. Add the blended flour and stir constantly until it has boiled thoroughly.

Finding what the colonists used for food The great variety of food we have to-day and the ease with which we get it from such distant places will be more appreciated by consideration of the difficulties of the colonial and pioneer days. A review of the foods of Indians will be of assistance. Industrial histories of the United States will be of some help. Find what the colonists at Plymouth ate. Many histories state that they planted crops, but that these failed the first year and a starving time followed. What did they do then? History states that the reason for crop failure was their attempt to grow crops unsuited to the New England soil and climate. Failing in these efforts, they turned to the harbor and Cape Cod Bay, which contained a supply of fish. Ex-

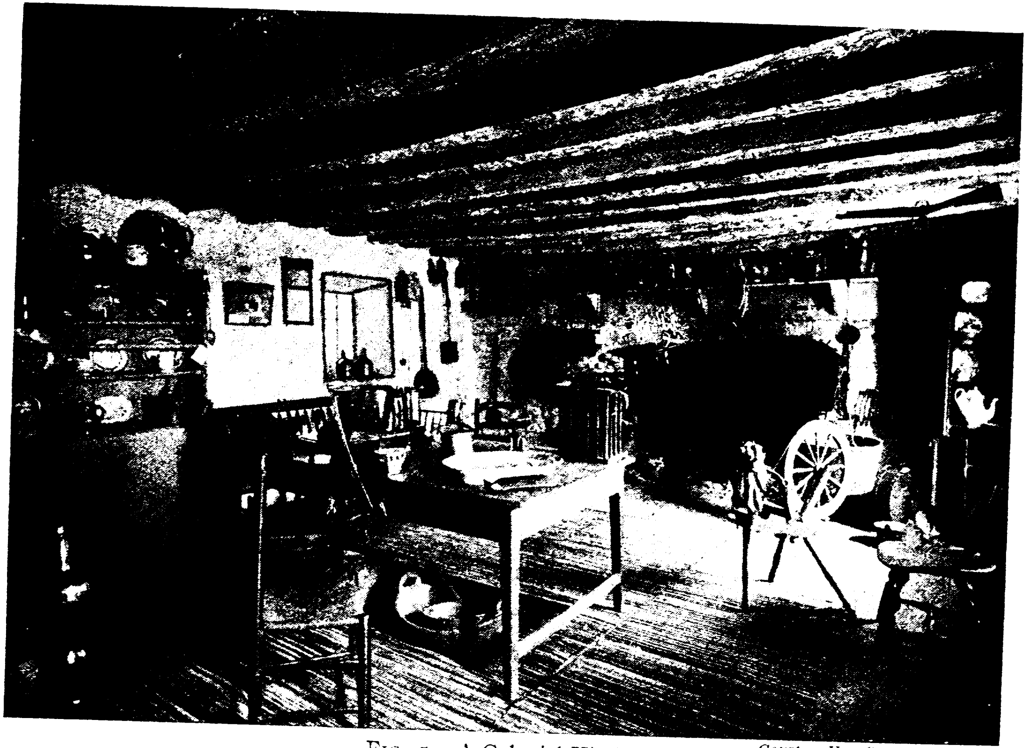

FIG. 5. A Colonial Kitchen

Courtesy Van Cortlandt Museum

Note the oven in the wall to the left of the fireplace; the crane on the right, on which are hanging two kettles; the candle molds on the table; and the bread box and chopping bowls beneath the table.

hausting the supply near shore, they went farther out. This necessitated building more seaworthy boats and led to the New Englanders' becoming builders of sailing vessels — in fact, some believe this was the initial cause of their becoming builders of the *Yankee Clipper*.

The colonial kitchen is indicative of the problems relative to foods. The oven, the crane, the spit, the kettle on legs, the churn, the coffee mill, the iron teakettle, represent very definitely the processes that went on there.

Making sugar. The making of maple sugar is an interesting process. If it is possible to secure some sap of the sugar-maple tree, it is worth while to have the children try boiling it down.

Finding what the pioneers did for salt. See if the children can find any references to the problem of salt in pioneer history. In Eva Emery Dye's *The Conquest*, there is an account of Lewis and Clark's arrival at the Pacific. The first thing they did was to take some ocean water and boil it down for salt. Find the relation of the Kentucky salt licks to the problem of Daniel Boone and his fellows in settling there. The Indian trails north and south led through this part of Kentucky because its salt licks made it a good hunting ground. From where does the salt come that we use to-day?

Desirable outcomes in Grade IV. From this work the teacher may expect:

1. A larger notion of our dependence upon others for foods.
2. A clearer concept of world intercourse through learning the sources of some of the foods we eat.
3. Some knowledge of how dried fruits are prepared.
4. A rather definite notion of the food value of eggs, their preparation, and ways of storing them

5. A clearer understanding of starch and its value as food.

6. A clearer understanding of how starch should be cooked.

7. More information about the importance of vegetables in the diet and the better ways of preparing them.

8. Interest in the ways the colonists and the pioneers secured food and the influence of food problems upon their history.

GRADE V

Finding how wheat is made into flour. The work of the fourth grade on starch, on colonial foods, and on macaroni all call for investigations of the milling of wheat into flour. Get some wheat and grind it into flour. Sift it several times and note the change. Write to some large flour-milling company for illustrative material showing the processes in great mills to-day. Compare the sifting through the cloth with bolting in the mill. What is removed by the process? Is the flour as wholesome as before? Find the history of an old mill, run by a water wheel and using mill stones for grinding, if there is such in the community. Borrow an Indian mortar and pestle if possible. Read Matthew 24 : 41 : "Two shall be grinding at the mill." What does this mean? In this sort of mill the upper stone had two handles sticking up near opposite edges. Two people sat on the ground. Each grasped a handle and turned the stone half around. Then each grasped the other handle and turned. The weight did the grinding. The grain was fed in at the center. It gradually came out as flour at the circumference.

Finding how wheat flour differs from the flour of some other grains. Take quantities of about two tablespoonfuls each of wheat flour, corn flour, barley flour, and rye flour.

Put each in a four-inch square of cheesecloth, preferably double thickness, and close it into a bag, holding the edges with a rubber band. Wash each of these in a separate bowl of water by shaking back and forth gently. This should continue at intervals for twenty-four hours. The children should watch the water in each bowl to note any changes. Before opening the bags, have them express a judgment as to what they will find. They will probably say that the wheat will be sticky and look like white paste and that the corn will look like wet sand. It is doubtful if they have an opinion relative to the other two. Opening the bags will show the corn meal as anticipated. The barley and rye will be somewhat sticky. The wheat will give the surprise. If well washed, it will be a small gray ball of material which can be stretched somewhat like gum or rubber. To the exclamations, "What is it?" the answer should be, "It is gluten – the protein of the wheat." This is the time to establish the connection between the thing and its name.

Examine books which contain an analysis of these grains and see how our conclusions check.

Finding what the gluten does in bread. How does the gluten make wheat bread different? Have the children consider the qualities of gluten before they state an hypothesis. Let them stretch and work a ball of gluten and then put it into the oven to bake. It will come out greatly puffed up. The children, or some of them, will suggest the ability of the gluten to hold the bread together. Some, who know something of lightening agents, will suggest that it will tend to form a film to hold in the gases which are developed to lighten the dough. Write these hypotheses on the board. Plan an experiment to test them. Remember that the control part of an experiment should have every element except the one being investigated exactly the same as in the test so that we may interpret the results correctly. The children can make two pans of corn bread, using the recipe given in Grade III, having quantities and materials exactly the same in both except for the fact that the one uses all corn meal and the other half corn and half wheat flour. Before making the test, the two hypotheses that probably will be made should be written on the blackboard: (1) The bread containing wheat should be found to be much thicker, (2) the one without wheat will be found to crumble much more easily. Check these after the experiment, and they will be found verified.

Experimenting with yeast. The use of soda and sour milk suggests questions as to other agents for lightening dough. One that has been very common and is often not understood is yeast. Soak one-half of a cake of yeast in a little lukewarm water. Make a sponge by mixing flour and one-fourth of a cup of lukewarm water to the consistency of a pour batter. Stir in the yeast. Cover and put where it will be in a temperature of 68°. In an hour or so it will be well marked with bubbles. These are caused by the gas given off by the growing yeast plant. Save out a small amount of sponge. Make a dough, using the sponge, two cups of lukewarm water, one teaspoon of salt, a tablespoon of shortening, and flour enough to make a stiff dough. Note the size of the ball of dough. Cover it and let it stand in a warm place for an hour. Note the size. When it has doubled its size, knead it down and listen to the cracking and squeaking. What causes it? Note the size. Let it rise an hour again and note the size. Reserve a part of the dough for experimenting. Knead down and make into loaves. Bring out the fact that kneading distributes the gas evenly and does away with large gas spaces. Housewives speak of this as making the bread fine-grained. When the loaves have risen so as to increase the size about half, they should be baked. Loaves of ordinary size require about fifty minutes in the oven. Place part of the reserved dough where it will freeze. After it is frozen, thaw it out and put in a warm place and see if it will rise if given time enough. Place some of the remainder where the thermometer registers 100°. After it has been there fifteen minutes, put in a place where the temperature is 68° and see if it will grow. Leave some in the 100° temperature for only five minutes and some thirty minutes and see if the yeast in these will grow. Try some at 98° and some at 99°.

Look at the small amount of sponge that has been saved. See how much it has grown. Put a very small bit under a compound microscope.

Summarize. Bread that is chilled need not be thrown away, as the yeast plant is not dead, only retarded. Freezing does not kill the yeast plant. Heat of over 98° will kill the plant.

What causes sourness? There are bacteria in the air which may get into the dough and grow, a process we call *fermentation*. This makes the bread taste sour. Many housewives fear letting the bread become chilled because they think the chilled bread will not rise. The real danger is that the delay due to chilling gives more time for these undesirable bacteria to grow.

Finding other instances of bacteria. The souring of milk illustrates this growth of bacteria, which may be in the air or on the vessel in which the milk is put. Why scald milk containers? Why sun them? Not all bacteria are killed by scalding. In canning fruit, boiling is necessary. Why does canned fruit sometimes spoil?

Canning fruit. Can some peaches or tomatoes to illustrate how careful one must be to keep everything sterile. For directions see Grade I.

This will raise questions relative to canning vegetables. Some will recall that it is only recently that mothers have done much canning of asparagus, corn, and beans. Now one may find a number in a community who can vegetables by the cold-pack process. Consult the list of government publications to find those which teach cold-pack canning. Farmers' Bulletins, Nos. 839 and 853, are especially helpful. Write for some of these bulletins. Find out how the vegetables are blanched and why. Why are the lids not closed tight before being put into the vessel to be boiled? Why is it important not to remove the lid before closing it after boiling? Look through magazine advertisements for advertised pressure cookers. See what information about canning they give. How much time do they require for boiling? The bacteria which need killing in canning vegetables require more boiling than those in fruit. This explains why they were difficult to can before the cold-pack process was perfected.

Discussing ways of washing dishes. If germs and bacteria are so prevalent, how can we be sure that dishes are clean? What does soap do toward making dishes sterile? What does hot water do? When is it necessary to boil dishes? What are the advantages of a draining basket? What precautions should be taken?

Finding out how ice cream freezes. Why is salt used in freezing ice cream? Put some cracked ice into a pail of water. Note the temperature of the water at the beginning and again in fifteen minutes and then in thirty minutes. Prepare another pail with water of the same amount and temperature as the first pail. Put into this second pail an amount of cracked ice equal to that used in the first pail but add a quantity of salt equal to one-third the ice. Note the temperature in fifteen minutes and again in thirty minutes. The temperature of the water in the second pail will fall until the water begins to freeze. Then it remains constant until the water is frozen or the ice melted. This stationary temperature is 32° Fahrenheit.

If a small quantity of cream in a thin-walled container were immersed in this water while at 32° F. it would freeze. The salt forces the ice to take up the heat of the water and cream until they are cooled to 32° F., when the freezing begins. Follow this experiment with making some ice cream.

Making a collection of labels or advertisements of as many different products of meat and the packing house as possible. When the work in geography comes to the study of the cities where packing houses are located, a little time may well be given to the study of the meat industry. Collect advertisements and labels representative of as many things made from meat by the packing houses and auxiliary industries as possible. Write letters to some packing houses for any advertising material they will send.

Making soap. One interesting by-product of the meat industry is soap. Get a quantity of wood ashes. Put into a barrel or keg, having a hole in the bottom. Place it on bricks or sticks, high enough for a vessel to catch the drip. Wet the ashes with water and let the mass stand for several days. Then pour on more water and catch the drip in a vessel. This drip is lye, to be used in making the soap. It contains caustic alkali. Strong alkali combines with fat to make soap. Put the meat scraps and grease to be used with the lye liquor into the kettle in which it is to be boiled. If possible get an iron kettle for soap-making to be used over an outdoor fire. Boil until the mixture becomes thick and ropy. Good soap depends upon right proportions of lye, water, and grease, which can be determined by experimentation.

Get a can of lye at a store. Read the directions on the label for making soap without boiling. Try a small quantity and note the small amount of labor required. Send to the Armour Bureau of Research, Union Stock Yards, Chicago, for a booklet, *The Story of a Soap Bubble*.

Collecting soup advertisements and labels. Make a collection of labels from cans of soup and advertisements of different varieties of soup. This raises the question as to what is necessary for a good soup. The making of soup stock will be found essential to this and to economy.

Making soup stock. Soups may be made from left-overs and scraps of meats. It is essential that the quantity used should be two-thirds lean meat and one-third bone and fat. To give color and flavor, brown one-third of the lean meat after cutting it into one-inch cubes, using the marrow of the bone for the browning agency. Cover all the ingredients with cold water — one pint to the pound — and allow to stand two hours. Add the browned meat, heat gradually, and cook slowly for six or seven hours. Strain and use as stock to which vegetables and seasoning may be added.

Visiting a meat market. The kinds of meat used in making soup stock suggests that there are several kinds, or cuts, of meat. Visit a meat market and have the butcher point out the various meat cuts and prices. Tabulate these. Find the relationship between high price and nutritive value and flavor. Do this by asking various good cooks. Consult any books available. Can cheap pieces of meat be made savory?

Cooking a pot roast. Buy a piece of brisket meat and pot-roast it. This is a process of slow cooking in a tightly closed vessel for a long time, preceded by searing on all surfaces. A bit of green pepper and of onion are liked by some as flavor. Note that by this process an inexpensive piece of meat may be made very savory and tender.

Finding how the food of the people who lived in castles was prepared. The study of meat cuts and ways to cook meat will be more interesting by contrast if the ways of cooking it different from ours are noted. Read the description in Scott's *Ivanhoe* of the meat at the castle of Cedric the Saxon, the night that Wamba, Gurth, Isaac the Palmer, and others hastened there before the storm. Note the amount of meat served and the great variety, but note the absence of any description of the way in which it was served. At that time there was a lack of the savory in cooking. Find out what you can about the scarcity and consequent value of peppercorns. They often were mentioned as part of the price the conquered were held to pay, just as if these peppercorns were rare jewels. In some of the histories which mention the causes which led to the discovery and exploration of the New World, it is said that people were interested in finding a way to the East because of the stories Marco Polo and other travelers told of the wonderful textiles and spices which came from the distant East. Then, too, many men returned from the Crusades in countries where foods were savory to a degree unknown to their native land. See what you can find of the history of spices and pepper. Your druggist may be able to suggest sources of information. Find how the food was cooked and served, and note how much more choice in variety and flavor our foods are. Note also the improvements we have made in cooking devices and methods.

Desirable outcomes in Grade V. From this work the teacher may expect:

1. Rather clear understanding of the development of the flour mill.
2. Some understanding of how wheat flour differs from other flours.
3. Some understanding of the yeast plant.
4. A rather clear idea of what is meant by lightening doughs and batters.
5. Some understanding of what bacteria do.
6. Intelligence about the process of sterilization necessary in canning fruit and vegetables.
7. An interest in the cold-pack process of canning.
8. Some appreciation of the process of refrigeration.
9. Knowledge of some of the great variety of meat products.
10. Knowledge of the essentials in soap-making.
11. A beginning of a knowledge of meat cuts.
12. A little insight into the fact that savoriness in meat is due not only to the price but to the way it is cooked.
13. Some appreciation of the luxury in variety and savoriness of foods which we enjoy as compared with what even princes had in the Middle Ages.

GRADE VI

The work of this year should include organizing and summarizing the work of the previous grades so that the children will leave the elementary school with intelligence about food problems and how to meet them.

Learning how to plan a meal. Each sixth-grade child should be taught how to plan each meal of the day so that the total will be approximately right in amount and kind. This will necessitate knowing what the total amount of food should be. There are age-weight tables given in standard books on dietaries. From these the children should learn to estimate quickly how many calories they need a day.

Professor Sherman[1] quotes standards arrived at by other investigators for apportioning the foods thus: proteins 15% to 18%, fats 7% to 11%, and carbohydrates 70% to 74%. Professor Rose[2] recently has recommended these proportions in terms of calories:

Vegetables and fruits	$\frac{1}{3}$	to $\frac{1}{7}$
Fats	$\frac{1}{8}$	to $\frac{1}{14}$
Sugars	$\frac{1}{8}$	to $\frac{1}{14}$
Meats, fish, cheese, eggs	$\frac{1}{8}$	
Milk	$\frac{1}{4}$	
Cereal foods	$\frac{1}{5}$	to $\frac{1}{3}$

The second column indicates the proportions for the most nutritious diet at the lowest cost. Children should know that they need from one to two cups a day of coarse, leafy vegetables. And each needs to know how to estimate calories in food portions.

NUMBER OF CALORIES PER POUND OF WEIGHT[3]

1 *Required for Growing Children per Day*

AGE	CALORIES	AGE	CALORIES
Sixth year	34–35	Eleventh year	28–32
Seventh year	32–34	Twelfth year	28–32
Eighth year	30–35	Thirteenth year	25–30
Ninth year	30–35	Fourteenth year	20–25
Tenth year	28–32	Fifteenth year	20–25

2 *Required for Adults per Hour*

When sleeping	0.42 Calorie
When sitting at rest	0.65 "

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[1] Sherman, Henry C.—*Chemistry of Foods and Nutrition*, p. 362. Macmillan.

[2] Rose, Mrs. Mary S.—Modern Priscilla, Vol. 37, No. 11, April, 1923, p. 22.

[3] From tables in Willard and Gillett—*Dietetics for High Schools*, pp. 35 and 39.

When engaged in light muscular exercise .	.	1.10 Calories
When engaged in active muscular exercise	.	1.90 "
When engaged in severe muscular exercise	.	3.00 "

Learning to know 100-calorie portions. It is easy to become familiar with the number of calories in a given quantity of each of the common foods. With this knowledge and the knowledge of what food principles are contained in each food, the child soon can learn to plan his meals with some degree of judgment as to what to eat.

100-Calorie Portions of Some Common Foods as Purchased from the Stores[1]

I. *Grain products*

Bread, brown — 1 slice, ¾ inch × 3 inches in diameter
Bread, graham — 3 slices, ⅜ inch × 2 inches × 3¼ inches
Bread, white — 2 slices, 2½ inches × 2¾ inches × ¼ inch
Cornmeal — 3 tablespoons
Crackers, graham — 2 crackers
Crackers, soda — 6 crackers
Grapenuts — 3 tablespoons
Macaroni — ¼ cup
Oats, rolled — ⅓ cup
Rice — 3 tablespoons
Shredded wheat — 1 biscuit
Zwieback — 3 pieces, 3¼ inches × ½ inch × 1¼ inches

II. *Fruits*

Apples — 1 large apple
Bananas — 1 large banana
Blackberries — ½ cup or 50 blackberries
Cranberries — 2 cups
Dates — 4½ dates
Figs — 1½ large figs

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[1] Compiled from Willard and Gillett — *Dietetics for High Schools*, pp. 19–25.

Grape juice — ½ cup
Oranges — 1 large orange
Prunes — 4 medium-sized prunes
Raisins — ¼ cup

III. *Vegetables*

Asparagus — 20 stalks
Beans, dried lima — 2 tablespoons
Beans, string — 2¼ cups, cut in pieces
Beans, dried white — 2 tablespoons
Cabbage — 5 cups shredded
Cauliflower — 1 small head
Celery — 4 cups, cut in pieces
Corn on cob — 2 ears, 6 inches long
Lettuce — 2 large heads
Peas — ¾ cup
Potatoes, sweet — 1½ medium size
Potatoes, white — 1 medium size
Radishes — 36 radishes
Tomatoes, fresh — 2 or 3 medium size
Tomatoes, canned — 1¾ cups

IV. *Dairy products and fats*

Butter — 1 scant tablespoon
Cheese, American — 1⅛-inch cube
Cream, thin — ¼ cup
Cream, thick — 1⅓ tablespoons
Cream, whipped — 2 tablespoons
Egg, in shell — 1½ eggs
Egg, white — 7 whites
Egg, yolk — 2 yolks
Milk, whole — ⅝ cup
Olive oil — 1 tablespoon

V. *Meats*

Beef, round, broiled — slice 4 inches × 3 inches × 1⅛ inches

Lamb chops — 1 chop, 2 inches × 2 inches × ½ inch
Pork, bacon, fried — 4 to 5 small slices
Oysters, raw — 6 to 12 oysters, ⅔ cup

VI. *Nuts*

Almonds — 12 to 15 nuts
Brazil nuts — 2 nuts
Peanuts — 20 to 24 (single) nuts
Walnuts, English — 8 to 16 nuts

VII. *Sweets*

Cocoa — 3½ tablespoons
Honey — 1 tablespoon
Sugar, granulated — 2 tablespoons

Keeping a height and weight chart. The interest in correct diet will be accentuated if a height and weight chart is kept as suggested in Grade III. It will put before the children the importance of eating carefully as a means to health and growth.

Summarizing the six food principles. Carbohydrates, fats, proteins, water, minerals, and vitamines have been included in several studies throughout the grades, directly or indirectly. Some ways of recognizing them have been noted. It is important that the presence of each of these in the common foods should be known, if there. Make a list of all the common foods and find out what each contains of these six principles. Chart the findings to make them accessible. Farmers' Bulletins, especially Nos. 142, 717, and 808, give these facts. Further aid can be secured from books on dietetics.

This should result in a pretty clear summary of what each day's meals should contain in food principles and the foods from which to select and get these.

Learning the four types of flour mixtures. In speaking of flour mixtures it is convenient to know the four terms and their meanings.

1. Pour batter — one cup of flour to one cup of liquid — pan cakes, fritters, popovers.
2. Drop batter — two cups of flour to one cup of liquid — muffins, cake, gems.
3. Soft dough — three cups of flour to one cup of liquid — yeast bread, biscuits.
4. Hard dough — four cups of flour to one cup of liquid — pie crust, cookies.

Finding the several ways of lightening doughs and batters. Some work is indicated in preceding grades, illustrating the biological method — growing the yeast plant which gives off carbon dioxide which lightens the dough. There is also an illustration of the chemical method of mixing soda and an acid, and thus producing a gas. This may be shown by mixing soda and lemon juice or sour milk in a bottle closed with a cork containing a glass tube discharging under the water in another vessel. Watch for gas bubbles.

A third way is a physical way. Rolling the dough and folding air into it will make it light through the expansion of the inclosed air. Take a small quantity of pastry dough, made by rubbing shortening into dry flour, salting, and adding cold water enough to make a hard dough. Let it become cold. Then roll out thin and smooth. Fold up, inclosing the ends so that the air cannot escape. Roll thin, fold again. Repeat the process again and again, being careful to put the dough where it will become very cold after every few rollings. Count the probable number of folds. Put in a hot oven and bake It will puff up so that you can see the many layers forced apart by the expanding air.

A fourth way is also a physical way. It is by beating the whites of eggs so that they inclose much air and carefully folding the egg within the batter. Baking this causes a light mixture because of the expansion of the inclosed air.

Considering economy in buying. Prices at stores.

1. Baker's Cocoa	
1 lb. box	.36
⅕ lb. box	.10
Save	.14
2. Flour — Gold Medal	
24½ lb. sack	1.26
3½ lb. sack	.25
Save	.40
3. Dates — Dromedary	
10 oz. package	.21
2½ oz. package	.10
Save	.19

4. Raisins — Sun Maid Seedless	
15 oz. package	.31
1½ oz. package	.05
Save	.19
5. Peas — Flag canned	
1 lb 4 oz. can	.28
11 oz. can	.20
Save	.08
6. Grape juice	
Quart bottle	.75
¼ pint bottle	.15
Save	.45

Study these prices. Compare with prices in local grocery stores. What suggestions do they give as to method of buying? Do large and small quantity packages of all foods show such discrepancy between the two prices?

Desirable outcomes in Grade VI. From this work the teacher may expect:

1. Ability to select foods relative to bodily needs so that the meals approximate a balanced diet.
2. Knowledge of the common one-hundred-calorie portions.
3. Knowledge of how to find how much one should eat.
4. An interest in keeping height and weight up to standard.
5. Knowledge of the food principles in the more common foods.

6. Intelligence about flour mixture terms.
7. An understanding of lightening doughs and batters
8. Interest in economy in buying food.

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Chapter on foods contains much detailed information on weights and measures, dietary principles, food values, body requirements, and calorie portions.

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A geographical reader describing production of various common foods. Can be used by children of the intermediate grades.

COOLEY and SPOHR. — *Household Arts for Home and School,* Vol. II. Macmillan.

Helpful on care of home, laundering, cooking, serving, selection of foods, and hospitality Written for elementary and junior high school girls

KINNE and COOLEY. *Food and Health* Macmillan.

Contains detailed information on preparation of meals, canning, food values, menus, sanitation, calorie portions, and food costs. Suitable for use by children of the upper elementary grades

ROSE, MARY S. — *Feeding the Family* Macmillan

Very detailed on food values and dietary requirements

SHERMAN, HENRY C. *Chemistry of Food and Nutrition.* Macmillan.

A source of technical information relative to foods, digestion, and dietary standards.

WILLARD and GILLETT. — *Dietetics for High Schools.* Macmillan.

A high school text helpful as a reference for teachers in learning how to estimate dietaries in terms of calories

Numerous bulletins issued by the Superintendent of Documents, Washington, D. C Send for lists. The Farmers' Bulletins are especially valuable.

CHAPTER VIII

SUGGESTIONS FOR THE STUDY OF CLOTHING

GRADE I

Discussing mother's work in providing us with clothing and caring for it. In discussing what is contributed to the family welfare, the children find that one important thing mother does is to see that each member of the family has the clothing he should have and that it is kept in order. In Grade I it is profitable to take time to discuss the various processes involved in the work of mothers, encouraging the children to tell, as they will, the way their mothers do these things. This exchange of ideas enlarges the child's notion of the work so that his ideas tend to become more generalized, and he begins the growth of the notion of interdependence. Dramatization helps to make this discussion more real. A still more effective method is to take advantage of the children's natural interest in dolls and let the discussion center around their activities with these.

Making dolls. It may be advisable to use real dolls, but in many schools it will be necessary to make them. This can be done by shaping old stockings and stuffing them for the body, head, arms, and legs. Old rope, raveled, can be used for hair, and faces can be painted to complete the dolls.

Dressing the dolls. Just as mother provides her family with clothing, so the children should clothe their dolls. In this work the teacher should keep in mind some of the points mentioned in Chapter VI. The work must not be so difficult and complicated as to discourage. It must not be so fine and tedious as to overtax young eyes and fingers. There must be enough following of industrial processes to satisfy requirements of form and use.

Soft flannel is easy to sew. It does not fray readily and so does not need hemming. Procure an assortment of many colors. This forces the children to make choices as to color combinations for the costume, which easily may include dress, cape, and cap. This gives occasion for discussing colors and their combinations as illustrated in their own clothes and may serve to develop an interest in this important element in dress.

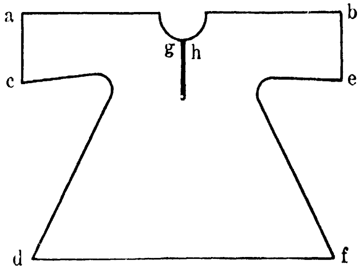


FIG. 6 Pattern for the Doll's Dress

Making the dress. The "kimono" dress is best suited to the possibilities of little children because it calls for but two seams to be sewed and it is cut in one piece. A pattern should first be made to insure fitting the doll and to teach planning before cutting. Two measurements, using a tape measure, are needed — (1) the length from the shoulder to the bottom of the desired dress, and (2) the length from the lower edge of one sleeve across the shoulders to the lower edge of the other sleeve — the line *ab* in Fig. 6. With these measurements a drawing should be made of the pattern. When it is cut it should be fitted to the doll. When ready it should be pinned to the cloth. The edge, representing the sleeve, — shoulder-sleeve line *ab*, — should be pinned along the fold of the cloth. To facilitate slipping over the head, a slit may be cut down the front. The sewing is along the two lines *cd* and *ef*. Ribbons may be sewed at *g* and *h* for ties.

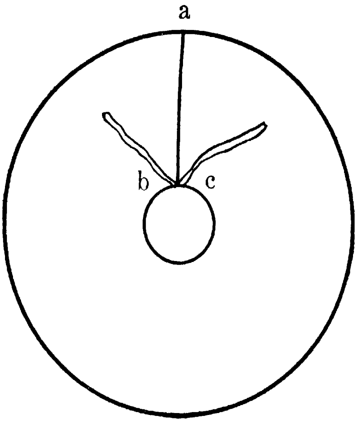


Fig. 7 Pattern for the Doll's Cape

Making the cape. The cape is easily made by cutting a half circle or a circle, according to the fullness desired, and cutting out the smaller circle for the neck. See Fig. 7. The length of the cape is the length *ab*. A pattern should first be cut. To draw the circle, a circle marker may be made of strips of stiff manila paper by the children. In Fig. 8, *a* is the hole for the pencil, and *b* indicates pinholes, the pin being inserted in the hole the desired distance from *a*.

Pieces of ribbon may be sewed at *b* and *c* for ties.

Making the cap. Using the circle marker, draw a half circle as in Fig. 9. The straight line *ab* should be long enough to reach from the neck below the ear, over the doll's head, to the same place on the other side of the doll's head. The dotted line *ab* represents the gathering thread. Ties may be attached at *a* and *b*.

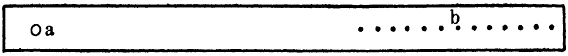


Fig. 8. Pattern for a Circle Marker

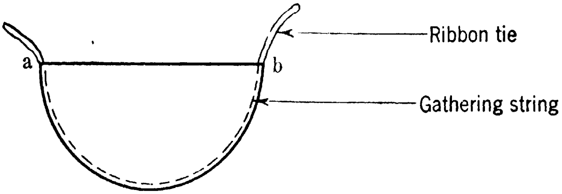


FIG. 9. Pattern for the Doll's Cap

Compare the clothing of dolls with that supplied children by their mothers. The educational values in this work are incomplete without developing a larger notion of the meaning

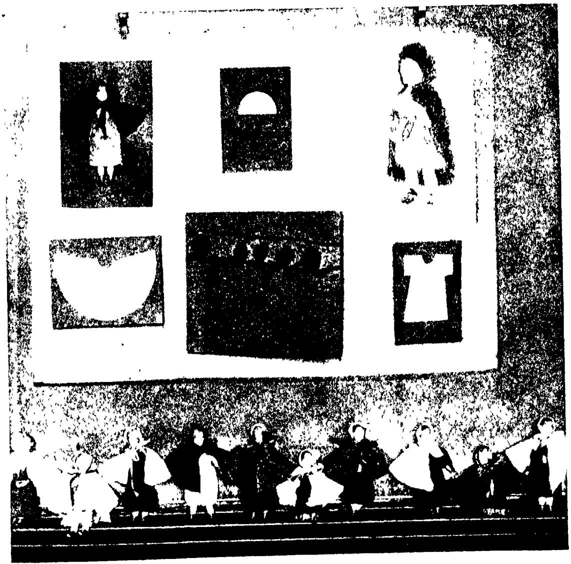


FIG. 10. Dolls Dressed by First-Grade Children in Speyer School

of the children's own clothes in terms of what mother does in providing the garments. This will come largely through exchange of ideas and comparison of what is done for the dolls with what is done by mother. This will include questions of choice of color, choice of material, style of garments, care of the garments, and repair and cleaning of garments. The discussion of materials will call attention to cotton, silk, and wool. Probably linen will not need mentioning. The source of these from the plant, the worm, and the sheep will naturally come in. The appropriateness of these materials to various uses will need consideration. Silk and wool are more expensive and less easily cleaned. Silk is least durable, but most attractive for special occasions. Silk is sleek and shimmery; wool rough but soft and warm; cotton durable and cheapest. When and where each should be used may be topics of discussion.

Washing the clothes and household textiles. The work from here will naturally turn to the making of a doll house as suggested in Chapter IX on Shelter, and this in turn will call for curtains, bedding, tablecloth, and napkins. Then naturally will come tea parties, which may be an outgrowth of the mid-morning luncheon. See Chapter VII on Foods.

In course of time some of these situations will call for washing the household textiles or some doll clothes. This will naturally lead to discussions of how mother washes clothes and how she keeps clean those that cannot be washed. The process should be understood, to a degree, as the children engage in washing their dolls' things. This may include the reasons for using soap, rubbing, using warm water and clear rinse water, and the reasons for hanging the clothes in the air and sunlight. The action of soap, warm water, clear rinse water, sunlight, and air should be made plain.

Other desirable activities. 1. Making collections of samples of cotton, woolen, and silk pieces.

2. Cutting out pictures of children's dresses, coats, hats, shoes, capes, and gloves and mounting and labeling them.

3. Cutting out, mounting, and labeling pictures showing the processes of washing clothes and the materials and equipment used.

4. Making lists of the children's clothing.

Desirable outcomes in Grade I. From this work the teacher should expect:

1. A beginning of the idea of interdependence.
2. A larger appreciation of mother's work in caring for them.
3. Some little interest in color choices and combinations.
4. Some attention to the shapes into which materials are cut for garments.
5. Ability to cut circles and half circles.
6. Some knowledge of the source of cotton, wool, and silk.
7. Some slight ability in discriminating cotton, wool, and silk by feeling.
8. A little judgment as to when cotton, wool, and silk are appropriate.
9. Some understanding of the process of washing clothes.

GRADE II

Finding where the clothes come from. The second grade should continue the notion of interdependence as seen in family life by extending it to the community and more remote connections. One element to consider is the source of the clothing. In the fall children's attention is somewhat occupied with the new clothes being provided for school use and for winter demands. Now is the time to raise questions as to where mothers get the clothes. Exchange of experiences and comparison of ideas soon bring the store to their attention. A trip to the store will naturally follow. Preparatory to the trip, the children should decide what they want to look for that they may be wise in their looking and questioning. This plan will include lists of garments and materials for garments, and perhaps prices. A letter may well be written by the children to the merchant asking permission to come. If the purpose of the trip is made known to him by the teacher, he will be able to show the children how things are arranged on the shelves, how the prices are marked, how the materials are measured, how they come to the store in boxes and cartons, and how they are labeled. This will lead to the fact that the merchant gets the clothing from some one more distant.

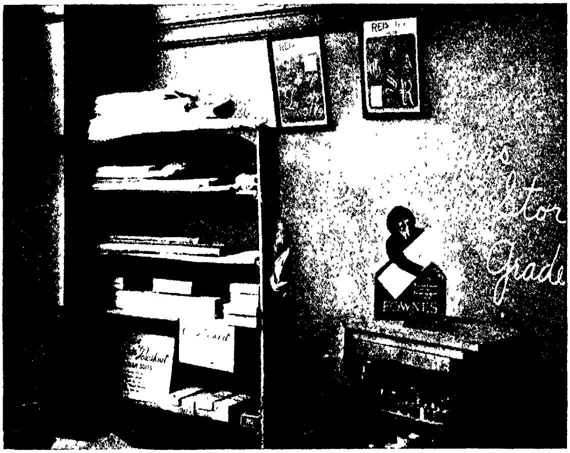


FIG. 11 A Second Grade Dry Goods Store

Making charts showing what the store does for us. The discussion of the trip will, of course, include writing letters thanking the merchant. It should further result in some summary of what was learned from the trip. This summary may take the form of charts showing what is sold by the store, prices and pictures of the garments usually worn by children, advertisements in the papers, and perhaps tags and labels used by the merchant or the factories that supply the merchant.

Courtesy Wamsutta Mills, New Bedford, Mass

FIG. 12 Picking Cotton

Finding out the sources of the materials used in making our clothing. In the first grade the children gained a slight acquaintance with the sources of cotton, silk, and wool. The interest aroused by the trip to the store may raise questions calling for more investigation.

Letters may be written to children in some cotton section asking for an exchange of experiences and illustrative materials. This will undoubtedly bring pictures of the cotton fields, cotton picking, and cotton plants. It may bring some cotton bolls on the stalk.

Separating the cotton seeds from the fiber. If cotton bolls are secured, the children will certainly enjoy trying to separate the cotton fiber from the seed. It may be well to try keeping account of the time used in this and weighing the total results of the efforts of the class. At the time of the invention of the cotton gin, "a man could, by hand-picking, clean only about a pound of cotton a day. The cotton gin cleaned as much in a day as had taken the hand picker a year to accomplish."[1]

In this handling of cotton the attention should be called to the length and curl of the fiber. An exhibit of cotton from field to finished products may be borrowed for one week by writing to the Wamsutta Mills of New Bedford, Massachusetts.

Growing some cotton plants. If the climate or schoolroom conditions are favorable, it may be well to encourage the children to plant some of the seeds to see if cotton bolls can be raised. Even though good bolls cannot be obtained, the effort will serve to make the cotton plant more real.

Finding how wool is made into cloth. The sheep is attractive to children. There are many stories about sheep and shepherds. Artists have delighted in painting sheep, and copies of their pictures are easily obtained. The life of the shepherd and his tender care of the sheep will appeal to the children. The accounts of washing and shearing sheep are full of action and will interest children. When the story proceeds to the later processes of making wool, the

[1] Earle, Alice Morse—*Home Life in Colonial Days*, p. 208. Macmillan.

children will need something tangible to follow. Some teachers have found it quite worth while to get a small quantity of wool just as it is sheared from the sheep's back. Let the children wash it in warm soapy water and then rinse it. Part of it can be dyed some bright color. After it is dry, card it. A pair of cards can be borrowed from some one in the community or can be bought from L. W. Watson and Company, Leicester, Massachusetts. The process of carding is quite easily learned. See page 139, Grade III. A little practice will give one sufficient ability. Perhaps some one in the community can show the children how it is done. The children can card some *slivers*, for so the rolls of fiber coming from the cards are called. They can twist these into coarse thread by rolling along the leg, at the same time stretching the sliver.

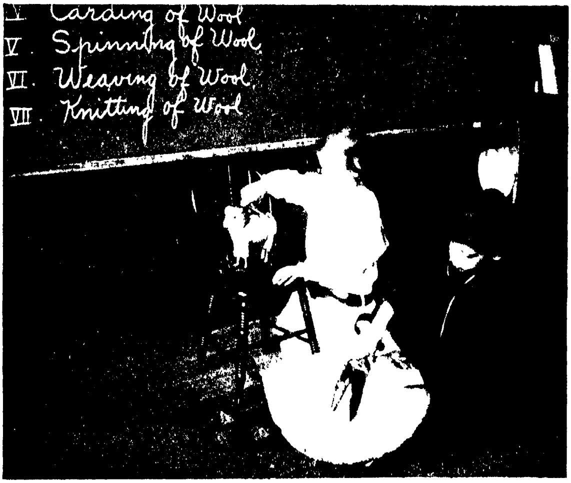


FIG. 13 Sheep Shearing

A frame can be strung with cotton thread for warp and these woolen threads woven in, thus making a rug for the doll house. In this way the children follow the process from fiber to fabric. They should be shown pictures of women spinning with wheels and of modern textile spinning machinery, so that they will not think thread is now made by rolling it on the leg. See Figs. 56, 57, and 256.

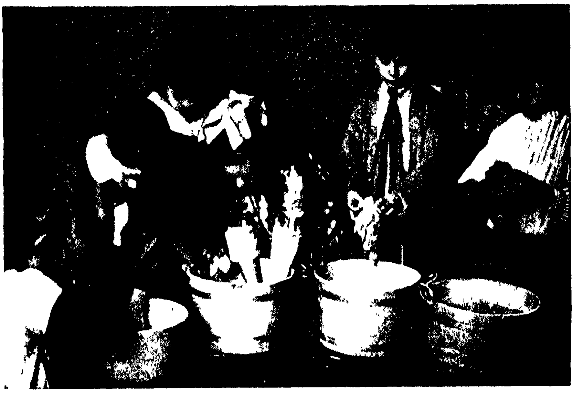


FIG. 14 Washing the Wool

Finding the characteristics of the silk fiber. In this consideration of the source of textile materials, the children may have learned that silk is spun by the silkworm. Some teachers have been able to buy some cocoons from a silk factory. If some can be procured, one or two may be soaked in hot water and the children may then try to pull out the long, tender fiber. Some silk ravelings of satin or good ribbon may be examined to compare the fibers from the cocoon with those found in the ribbon. Experience of this sort is helpful in teaching an appreciation of the delicacy of silk and qualities of the fibers.

Finding the characteristics of linen fibers. If possible, secure a few stalks of the flax plant. Soak them for three weeks and then dry. Carefully break all the woody and pithy structure and remove from the fibers. Note the length of these fibers, their strength and straightness. Secure some ravelings from a new linen tablecloth and compare with the fiber from the stalk.

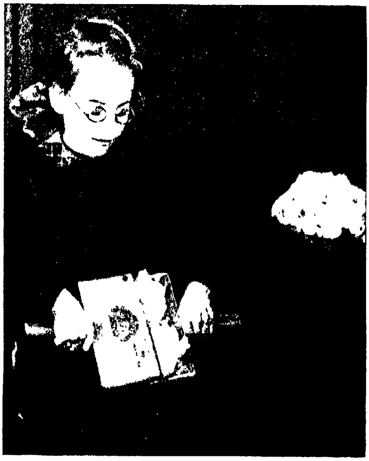


FIG. 15 Carding the Wool

Comparing the four fibers. The children will now be able to compare the four common fibers as to length, strength, straightness, smoothness or sleekness, and luster. If they are then burned, it will be found that the silk and wool leave a crust and burn with an odor like that of burning feathers. The cotton and linen burn so as to leave stubby charred ends. Breaking threads of the four will show differences in strength. Silk and linen are found to make very strong threads. When broken, differences will be found at the ends. Wool and cotton leave fuzzy or curly ends when broken. The wool stretches much when being broken. Untwist a thread of each of the four fibers and note the differences.

Making lists showing the uses of the four fibers. The children may become so interested in these fiber differences and their applications to cloth as to find it worth while to list the uses of each. These lists could be made into charts illustrated by pictures cut from magazines.

Making table linens and keeping the pieces clean. This discussion of the uses of linen will suggest the making of a lunch cloth and napkins. In some schools where a table is available a group of four children may be appointed each week to be the housekeepers, having as theirs the privilege of eating luncheon at this table. This provides a reason for making a lunch cloth and napkins and presents the problem of laundering them. Washing, bleaching, and ironing these gives basis for discussing why table linen should be white

FIG. 16 Booklets Resulting from the Study of Wool

and how it can be kept so. The work of soap, sunlight, and bluing in keeping these clean and white should be brought out.

Learning how to repair clothes and care for them. The trip to the store and questions about prices will suggest the need of care in making clothes last. Children can learn how to sew on buttons and why garments should not be worn without buttons — economic, æsthetic, and ethical reasons. They can learn that knitted goods should have the "runs" stopped immediately. Perhaps an old stocking can be used to let the children see how easily a hole "runs." They can see how each loop releases the preceding one. Experimenting with an old garment worn thin in places will show how much more easily it is repaired before a big hole results than afterward. All of this should enforce the idea that garments with holes in them should be repaired before they are worn.

Further discussion of care of clothes should emphasize the importance of hanging clothes up neatly, airing them often, washing them before they are badly soiled, and keeping them in drawers carefully folded, or in closets so arranged that they can easily be found.

Knitting. The discussion of "runs" in knitted goods may be reënforced by some spool knitting or some knitting on needles. Doll stockings can be knitted by the spool process by boring a hole of the right size in a block of wood, putting brads around the hole, and using the block as the "spool." A little spool knitting or a little needle knitting will teach the characteristics of knitted fabrics. Much is not advisable, as it soon loses the element of "finding out something," or learning.

Finding how the first clothing may have been made. The use in this grade of the primitive life material furnishes a contrast with present-day conditions. The stories as told by Miss Dopp (see page 92) help to make vivid the problems of primitive people. The most fundamental of their needs are for food, clothing, and shelter. The consideration of how these people provided clothing brings up questions as to materials used and methods of fashioning garments. The skins of animals were used first. The need for better covering led to the making of holes and the lacing of two skins together. See the account by Miss Dopp, telling of the beginnings of needles and sewing in *The Early Cave Men*, pages 58-60.

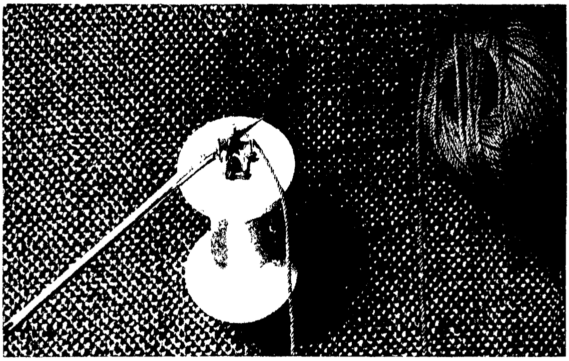


FIG. 17 Spool Knitting

Drying a skin. The children will be interested in drying a skin. A piece of calfskin, or cowhide, or a rabbit skin, or moleskin may be used. Stretch on a board. Remove pieces of membrane or flesh attached. Rub with salt and hang up to dry. Sometimes a mixture of salt and alum is used. When dry, scrape and rub until soft. The skin may be made into a garment for a doll. The moleskin makes a good purse.

Desirable outcomes in Grade II. From this work the teacher should expect:

1. A larger notion of interdependence.
2. Some idea of the business of the dry goods merchant.
3. Some idea of places where clothes are sold.
4. Ability to discriminate the four textile fabrics with some success.
5. A better appreciation of clean table linen
6. An understanding of why garments should not be worn with holes in them.
7. Knowledge of the knitting stitch.
8. An understanding of why holes in knitted fabrics "run" and what to do when "runs" occur.
9. Ability to sew on buttons
10. An interest in caring for clothes
11. Some notion of the beginnings of clothes and sewing.
12. An understanding of how a skin is dried.

GRADE III

Learning how to care for our woolen garments. Sweaters and woolen stockings are in evidence in the fall as cold days begin to come. Some very profitable work may result from beginning when interest in these garments is active, especially if these are new woolen garments being worn to school. This work may lead into many interesting questions of worth.

Finding how woolen garments differ from cotton, silk, and linen garments. Comparison of garments of various materials may lead to noting the "woolly" feeling, protruding hairs, loose weave, and porous quality as common characteristics. Some may know the excellent absorbent quality and the value of this as a protection against taking cold when becoming overheated. This explains the use of wool by athletes. Comparison of woolen garments with garments of other materials will quickly show the absence of these characteristics in the latter.

Examining wool to learn its nature. If possible, secure a sheepskin with the wool on it. If this cannot be done, get some wool as sheared from the sheep. It will need washing before it can be used.

Learning how to wash wool. In planning to wash the wool, children will make different proposals as to method. To decide the right method, they will need to know the peculiar structure of the wool fiber. If possible, borrow a compound microscope and make a mount of a wool fiber for the children to see. Or a good drawing may be put on the blackboard. Books on textiles usually contain good pictures of the wool fiber as seen under the microscope. See Fig. 52. Note that the fiber is in segments. Each segment is surmounted by sharp protruding hooks. It will readily be seen that in a garment of wool these hooks will be protruding in various directions. Rubbing soap on the garment in washing it, or rubbing the garment on a board, will tend to interlock the hooks and make the fabric become compacted, matted, felted. Examine a piece of felt and notice how closely the fibers are compacted.

When a woolen fabric is put in very hot water the segments are weakened so that they slip farther within each other, thus shrinking the fiber. Take two squares of flannel of the same size. Wash one in lukewarm water, the other in boiling hot water. When dry, compare the two in size.

The process of washing the wool must take account of these two facts: (1) rubbing felts the wool; and (2) putting in water that is too hot shrinks it.

Further handling of the wool will acquaint the children with the length of the fiber and its tendency to curl — two elements to be considered in making a thread. Compare these fibers from the sheepskin with the fibers to be obtained from untwisting some yarn or raveling a woolen textile, that the children may see that cloth and yarn are made of wool fibers.

Making a thread of wool. This examination of wool yarn and cloth will suggest to the children their trying to make the wool into a thread, perhaps into a textile. This will involve carding the wool as the first step.

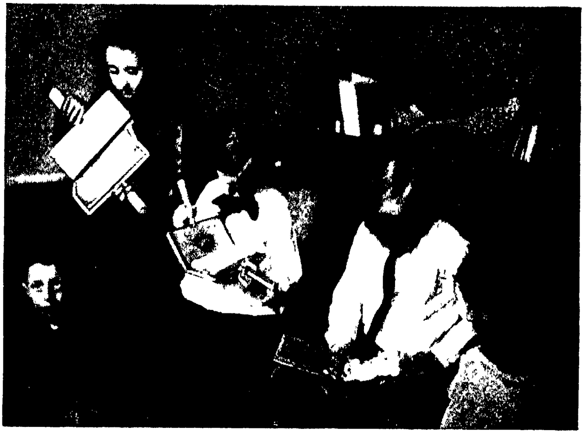


FIG. 18 Carding Wool

Carding wool. Some one in the community may be willing to lend a pair of cards, or a pair may be found in a store handling woolen blankets. They may be bought of L. S. Watson, and Company, Leicester, Massachusetts. Order the Old Whittemore Patent No. 9 Wool Cards.

Place a small handful of the washed wool on one of the cards. Hold this card in the left hand, resting the hand upon the knee. The card should be held so that the handle points away from the body and the wires are up. Draw the other card over this toward the body several times. This separates the twisted, knotted fibers as they came from the sheep's back or as they were left from the washing. It will be found that part of the wool transfers to the right-hand card. In order to make the sliver, the wool must be returned to the other card. This can be done by drawing the card in the right hand back over the other card, having both handles pointing away from the body. Continue carding. When the fibers are sufficiently separated, make the sliver by pushing the right card back over the left card, keeping the cards with the handles pointing away from each other, as in the original position. Shape the sliver by rolling the mass between the backs of the cards. This will make a fluffy roll as long as the cards, ready for spinning.

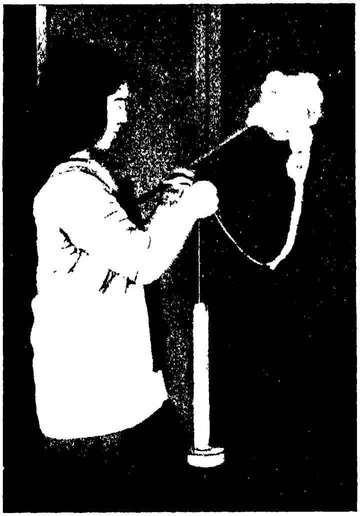


FIG. 19 Using a Spindle in Making a Thread

Making the sliver into a thread. The children will enjoy trying to twist a sliver into a thread, stretching it as they twist. Try attaching a small weight to the end of the sliver as you twist. A spindle can be improvised to use in trying to make thread. To make the spindle, attach a slender wooden rod, six to ten inches long, to a round weight placed on one end. On the other end cut a notch or attach a hook. The latter holds the spindle in a vertical position when the thread is attached.

Weaving the threads, so made, into a fabric. For the satisfaction of carrying the activity to its conclusion it may be well to weave this thread into a fabric. For this a small stick frame may be used. See Fig. 20. Use cotton twine for warp. Let each child weave his thread into the warp. This will give a small rug of uneven texture, usable in a doll house; or it may serve merely as an illustration of how a textile can be made.

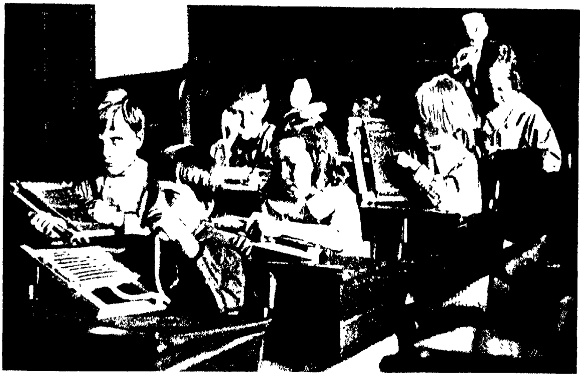
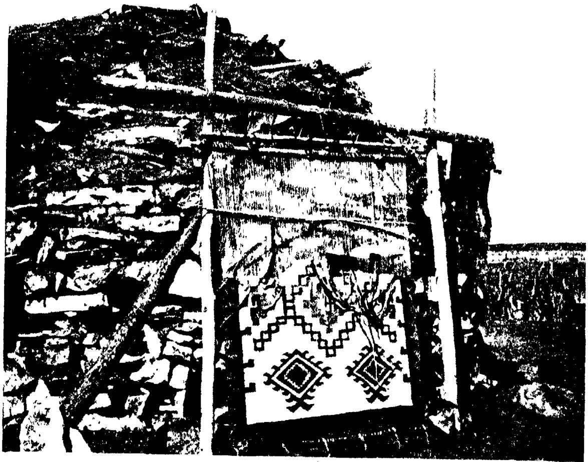


FIG. 20 Using a Simple Stick Loom in Weaving
Note the use of the rods to keep edges straight

Comparing these hand methods with what can be found of colonial processes. Pictures and stories of household industries in colonial days are quite common. It will be interesting to bring together such pictures and stories as can be found of the colonial ways of making thread and cloth.

There may be people in the community having cards, spindles, looms, spinning wheels, or some homespun cloth. If there is a woman in the community who will spin for the children, a visit to her home is well worth the time it will take.

Comparing the processes with those of the Navajo Indians. The Indian woman carded her wool by much the same hand process. She sometimes twisted these slivers into threads by rolling the slivers along her thigh, stretching the wool as she twisted it. She sometimes used a weighted spindle.[1] It was in her weaving that she showed ingenuity. Sometimes her loom consisted of a stick or pole. A pole was laid from one forked tree to another. The warp threads were looped around this and hung down the desired length, each being



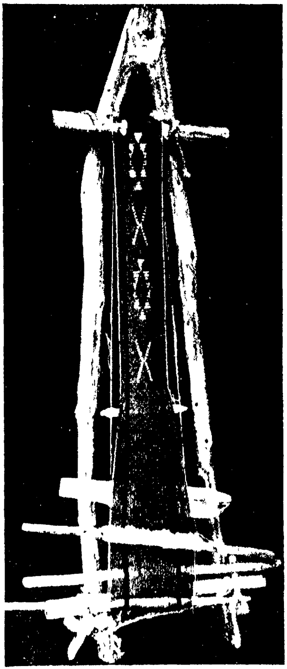
Courtesy American Museum of Natural History

FIG. 21. An Indian Loom Showing a Rug in the Process of Weaving

Note the use of heddle device and shed rod.

weighted at its end. Or, the lower ends were attached to a second stick. The weight of the stick served to keep the warp threads taut. At other times a stake was driven into the ground to which her loom, consisting of a forked stick, was attached. The other ends of the warp threads were attached around the woman's waist.

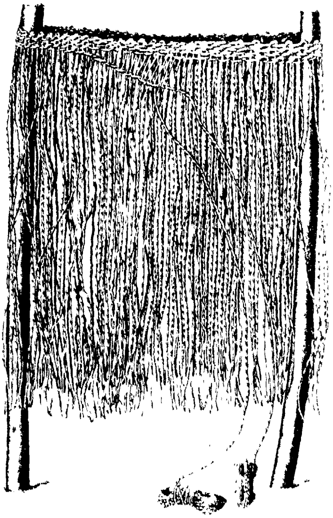
The Indian woman's ingenuity went farther in devising ways of expediting the weaving. The children will appreciate the tedium of picking up every other warp thread as the woof is put through. Her heddle device may be understood by tying a string to one end of a stick, passing it under the first warp thread, looping it over the stick, passing it under the third thread, looping it over the stick, under the fifth, etc. Now gently pull up this stick. All the odd threads will be drawn up, making a passageway under the odd threads and over the even threads. This passageway is called a *shed.* Another stick may be so attached to the even threads. For the weaving process, first pull up the odd threads and throw the shuttle



Courtesy American Museum of Natural History

FIG. 22. A Navajo Sash Loom

through the shed; then pull up the even threads and throw the shuttle back; and so on. *In attaching the stick to the warp threads, as given above, remember to allow several* inches of space between the warp threads and the stick.



Courtesy American Museum of Natural History

FIG. 23 An Ojibway Weaving Frame
Notice the twined process

Visit a carpet loom in the community, if one can be found, and find how the heddle idea is worked out in it so as to make the sheds.

Sometimes the Indian woman slipped a flat stick about an inch wide into the warp, over half the threads and under half. By turning this on edge a shed was formed.

Making a loom with a heddle device. This study of the looms devised by the Indian woman may suggest to the children the possibility of making a loom which will meet the same need. The loom shown in Fig. 24 is easily made. The two beams over which the thread is drawn are adjustable. The saw kerfs on these beams hold the warp threads in proper place. The heddle device serves to make the two sheds needed for plain over-

and-under weaving and also serves as a batten to pack the woof threads closely. It will be noted that the heddle device is made of narrow thin strips of wood. Each of the several

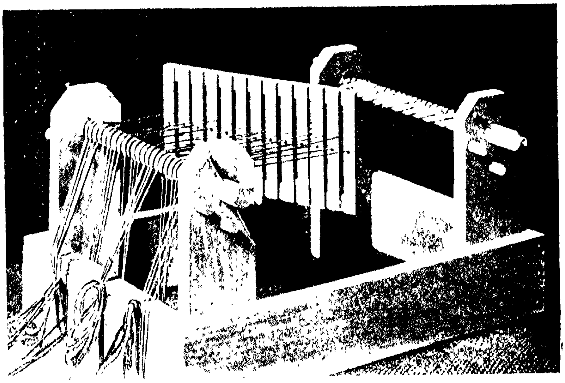


FIG. 24. Loom with Adjustable Beams and Heddle

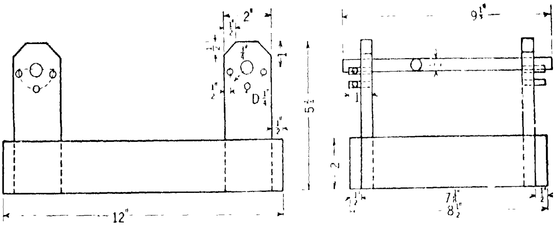


FIG. 25. Working Drawing for the Construction of the Loom

parallel strips has a small hole in it. Alternate threads are put through these holes, one in each. The other threads are put through the spaces between the strips. The small holes may be drilled but are more easily made by burning with a fine, heated rod.

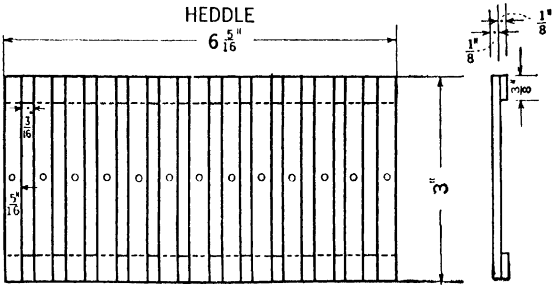


FIG 26 Working Drawing for the Construction of the Heddle Device

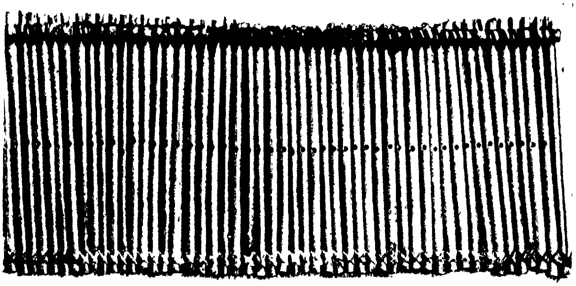


FIG. 27 A Heddle Made by an Indian

FIG. 28. A Shuttle for Weaving

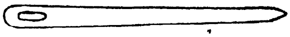


FIG. 29. A Needle Used in Weaving a Pattern

Weaving a rug. On this loom may be woven small rugs suitable for doll houses, or a "community rug" may be made

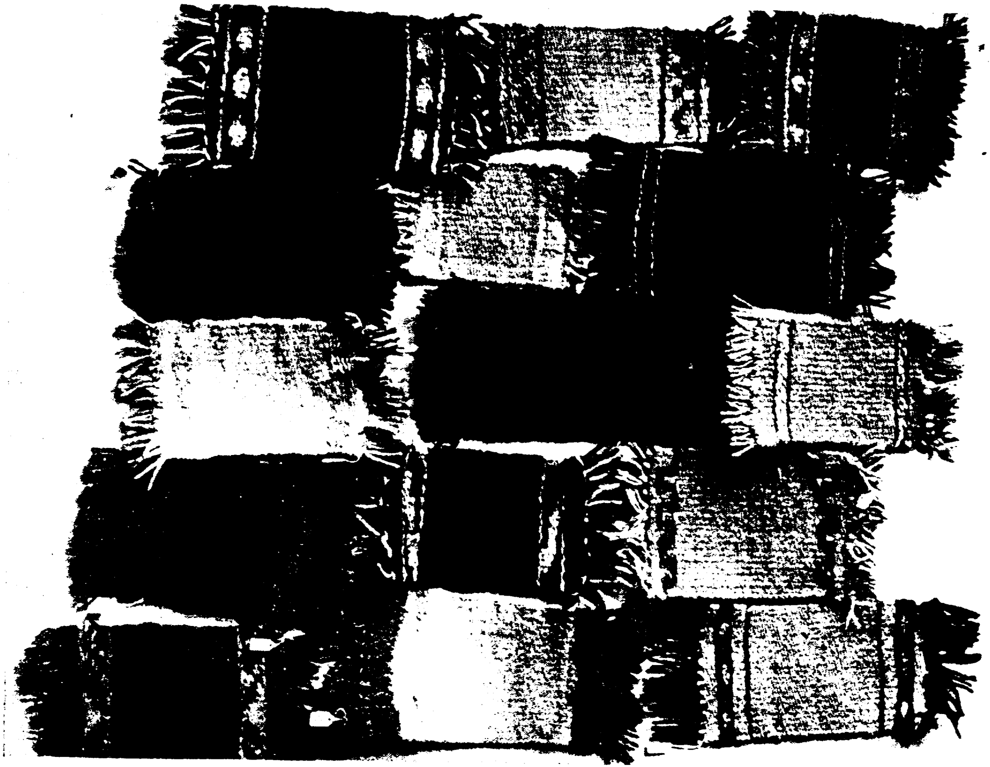


FIG. 30. Rugs Made on Looms of the Types Shown in Figs. 20 and 24

for which each child weaves a piece which is a definite part of the total design, the pieces being overcast together. After studying the design in Indian rugs, some attempt at woven design may be made. The pattern is first woven in with a needle and then the background is woven around it. For a firm texture it is well to interlock the background and pattern where they meet, as shown in Fig. 31.

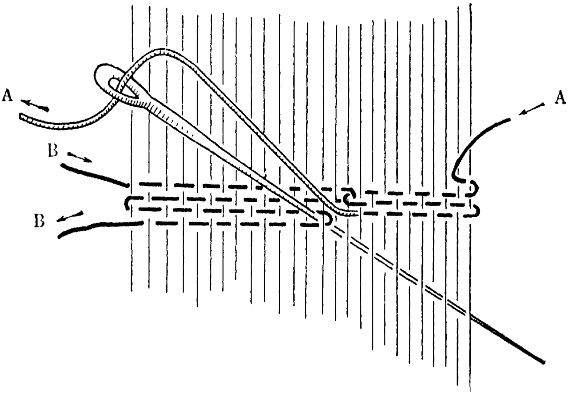


FIG. 31. Showing Method of Interlocking Threads of Two Colors in Weaving a Pattern

Finding how the wool is dyed. The consideration of the Indian woman's work will in all probability arouse an interest in Indian blankets. Some should be examined by the class, if possible. In doing this the children will begin to note the characteristic Indian colors. Then call their attention to the colors in colonial bedspreads and rag carpets. A different set of colors seems to be the type. This may arouse questions as to how the wool is dyed. Guide this interest into an attempt to find some materials in the environment which the children can experiment with for dyeing some of their wool.

In the fall, walnut bark is a commonly available material. The bark of red oak and hickory gives shades of yellow and brown. The flower of goldenrod, pressed, yields a juice which, when mixed with indigo and alum, gives green. Pokeberry boiled with alum produces crimson. The juice of the iris petals gives a bright purple. Sassafras bark or the root of the barberry will yield yellow or orange, as will the flowers and leaves of balsam. Iron rust will give a tan color. Other things may be found available for dyeing.

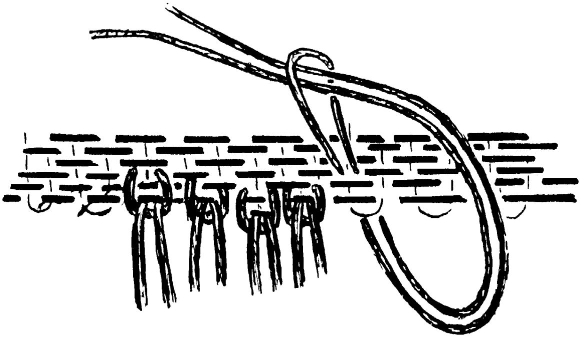


FIG 32 Showing Method of Making the Fringe on the Rugs in Fig 30

Compare the difficulty of the colonial and Indian women with the present-day methods in securing dye materials.

The Pocumtuc Housewife, a Guide to Domestic Cookery as It Is Practiced in the Connecticut Valley, was published at Deerfield, Massachusetts, in 1805. The following directions are taken from the booklet, pages 54-56:

"Straw Color. Steep saffron in an earthen dish and set with alum.

"Bird of Paradise Color. Steep the dry outside skin of onions.

"Rose Color. Steep balsam blossoms in water and set with alum. Darken the shade to red with a decoction of logwood.

"Madder Red. Dissolve three ounces alum, one ounce cream of tartar. Boil cloth in this two hours, then rinse in cold water. Dissolve eight ounces of madder in clear warm water. Heat it scalding hot. Put in the cloth and keep stirring all the time for an hour. Wash in strong suds. It makes the color brighter to add to the dye, after the cloth is taken out, a pint of clear lime water, then return the cloth and stir for ten minutes, not boil.

"Royal Purple. Soak logwood chips until the strength is out; then add alum, a teaspoonful to a quart of the liquor. If this is not bright enough, use more alum. When the dye is exhausted, it will color a fine lilac.

"Brown. Boil butternuts. Set with alum.

"Black. Boil logwood in vinegar in an iron kettle, one pound of logwood to a pailful of water. Add a little copperas to set the color. Some people say logwood dye always fades, but it is much used."

Finding how to recognize wool by the burning test. In addition to knowing its length, curl, and wooliness, the children can become better aware of its animal characteristics by burning. Burn a piece of wool as it comes from the fleece and a piece of woolen cloth. Then burn some feathers. The children will quickly recognize that both give off the "burnt feathers" odor. Burning a piece of China silk gives the same result. Try some cotton and linen pieces and note the difference. The animal products give off a "burnt feathers" odor.

Finding how to protect wool from moths. The study of the woolen fiber should include considering its protection from moths.. Find the different ways used to keep moths off, including the use of cedar chests, moth-proof bags, camphor,

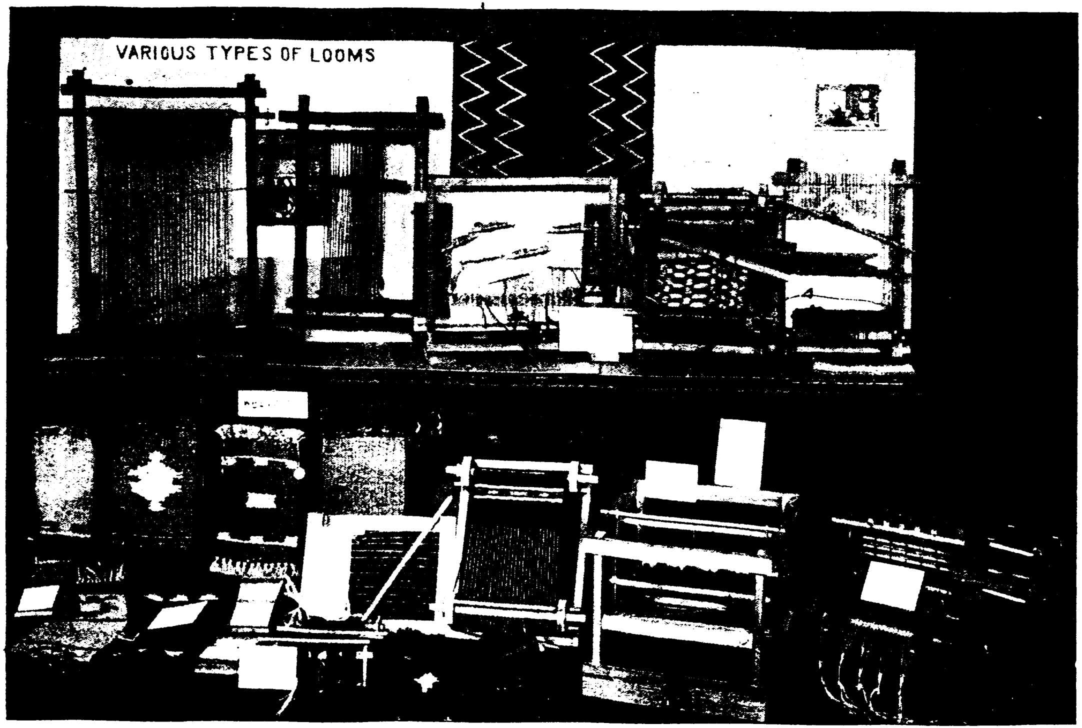
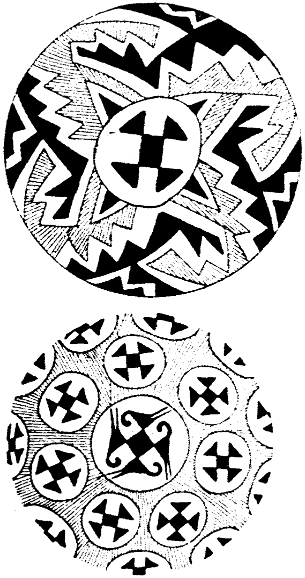
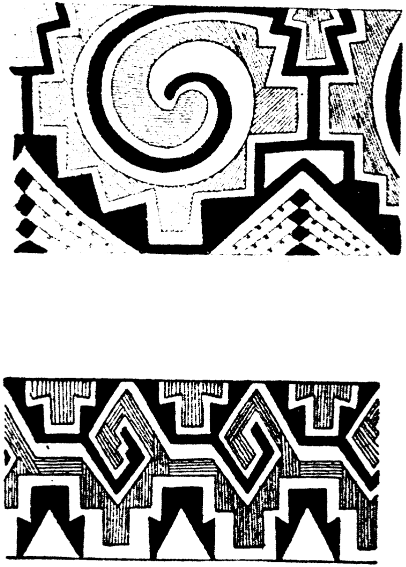


FIG. 33. Illustrating Different Kinds of Looms and Patterns in Weaving



Courtesy American Museum of Natural History

FIG. 34. Indian Designs

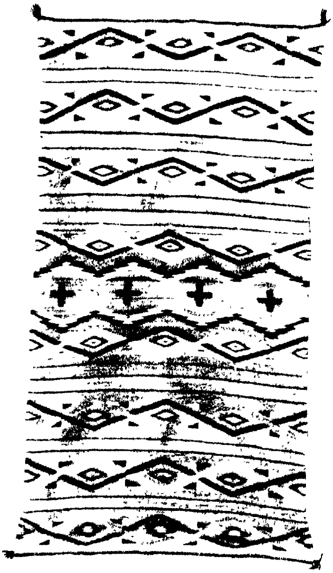


Courtesy American Museum of Natural History

FIG. 35. Indian Designs

moth balls, pepper, and tobacco. Find when moths are most active. Teach the recognition of the moth miller.

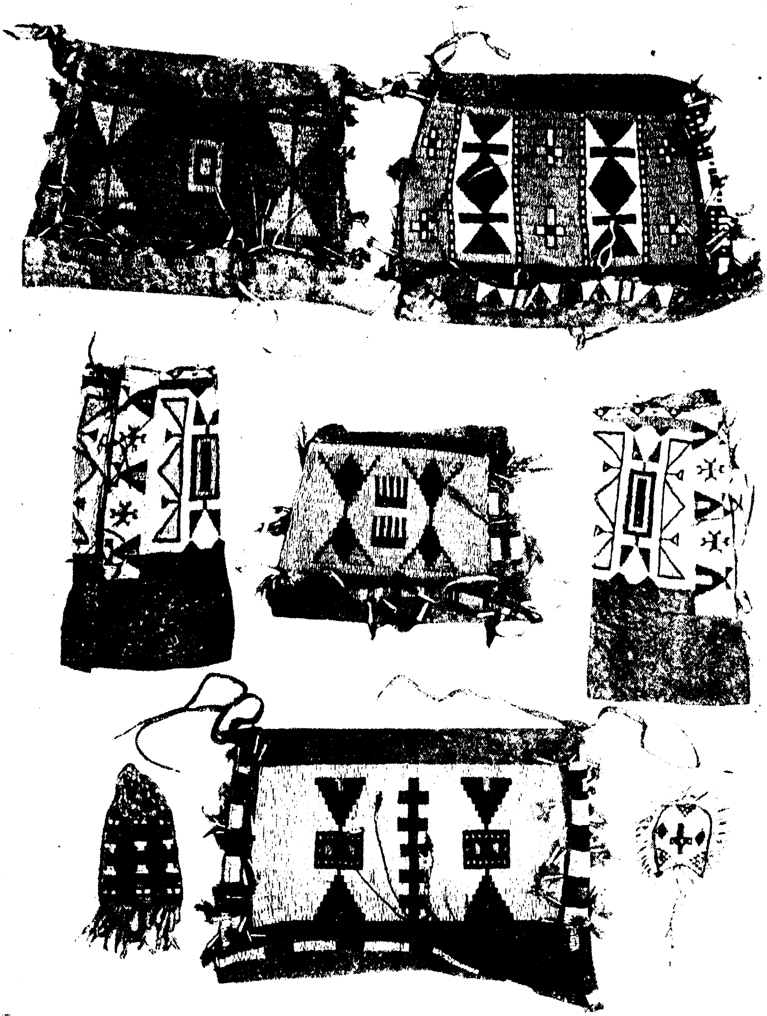
Collecting samples of various kinds of woolen fabrics. Interest may become such that it will be profitable to collect samples of as many different woolen fabrics as possible. Attempt to sort the samples according to the kind of design. Soon plaids, checks, stripes, mixtures, plain colors, and diagonals will become apparent. Let the children examine these to see if they can determine how the design is produced. Raveling the edge may be an aid in finding this out. Are any pieces found where the design is stamped on? Examine the Indian and colonial textiles which have been brought in to see how their designs are made. It will be found that in almost all cases the design is made in woolen cloth by means of some weaving device.



Courtesy American Museum of Natural History

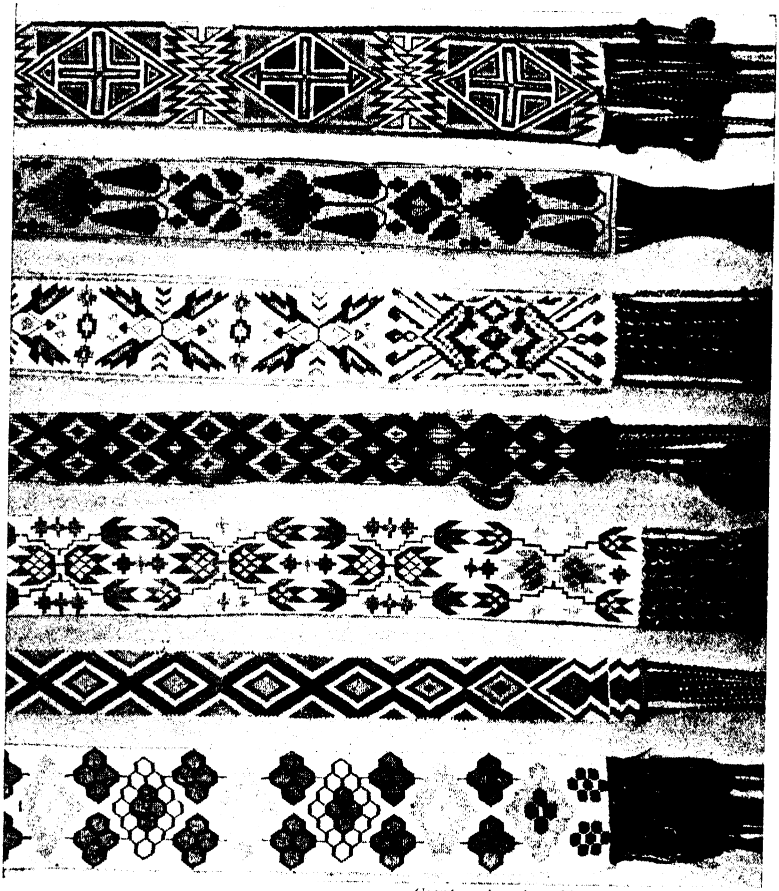
FIG. 30. Navajo Blanket Illustrating Much Use of Design

Studying the designs made by the Indian woman. When examining the design of the Indian blankets, the children's



Courtesy American Museum of Natural History

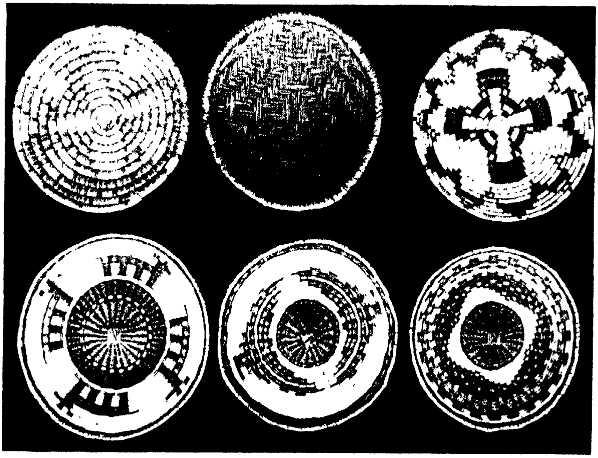
FIG. 37. Bead Work of the Sioux Indians Illustrating Designs



Courtesy American Museum of Natural History

FIG. 38. Beaded Belts Made by the Menomeni and Other Tribes of the Great Lakes Region

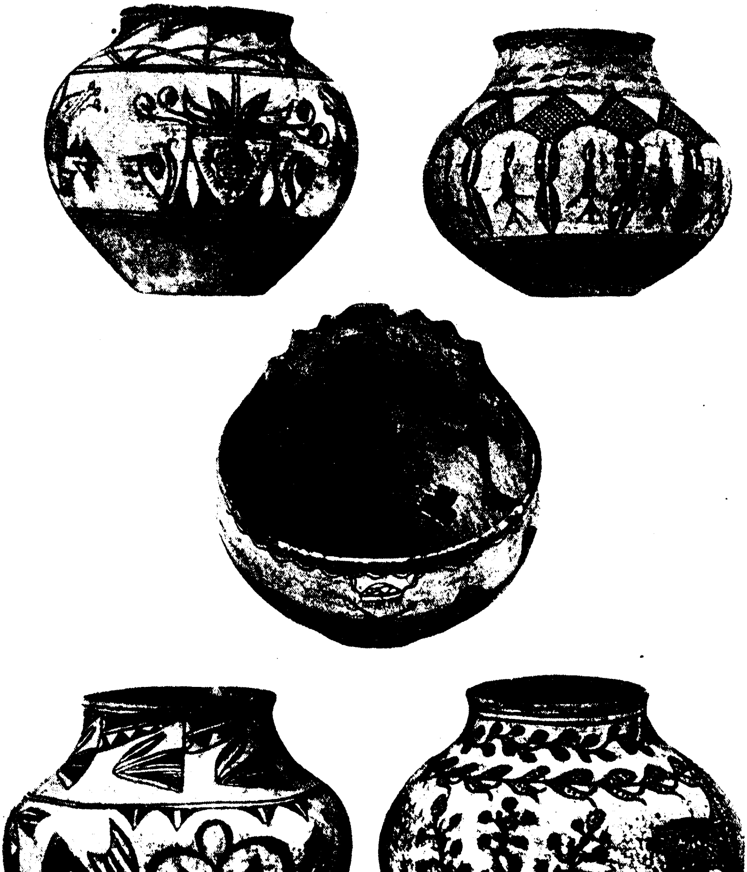
attention will be attracted to the characteristic patterns. The same will be noted on the blankets and pottery. In Jennie Hall's *Weavers and Other Workers*, page 93, is a simple account of what some of the more common designs may mean. Much of the material in this book will be found very helpful throughout this study of wool.



Courtesy American Museum of Natural History

FIG. 39 Hopi Baskets Illustrating Designs

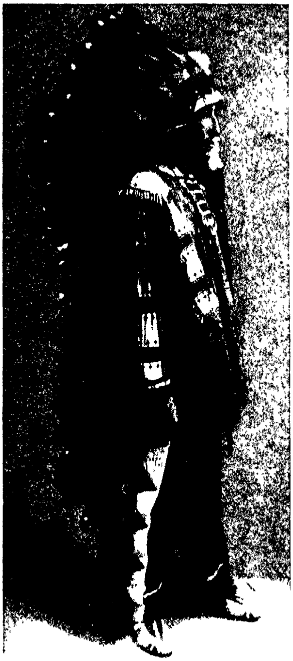
Emphasizing the importance of darning holes in knitted garments. The study of woolen garments would not be complete without taking up again the question of the care of knitted garments and learning how to mend a hole so as to prevent "runs." An old knitted garment of coarse texture may be used to examine some runs to see just what happens. Reference should be made to the knitting process of making loop within loop. This will help the children to



Courtesy American Museum of Natural History

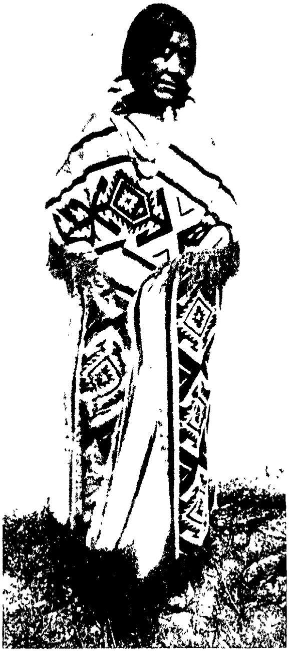
FIG. 40. New Mexico Indian Pottery Illustrating Designs

see that the loop must be fastened to prevent further "running," even before the hole is darned.



Courtesy American Museum of Natural History

Fig. 41. Dakota Indian in Sioux Dress



Courtesy American Museum of Natural History

Fig. 42 Indian Woman of New Mexico in Apache Dress

Finding what uses were made of skins. The consideration of Indian processes in making clothing will certainly call attention to the Indian moccasin as contrasted with our foot coverings. Questions easily will arise as to how they were

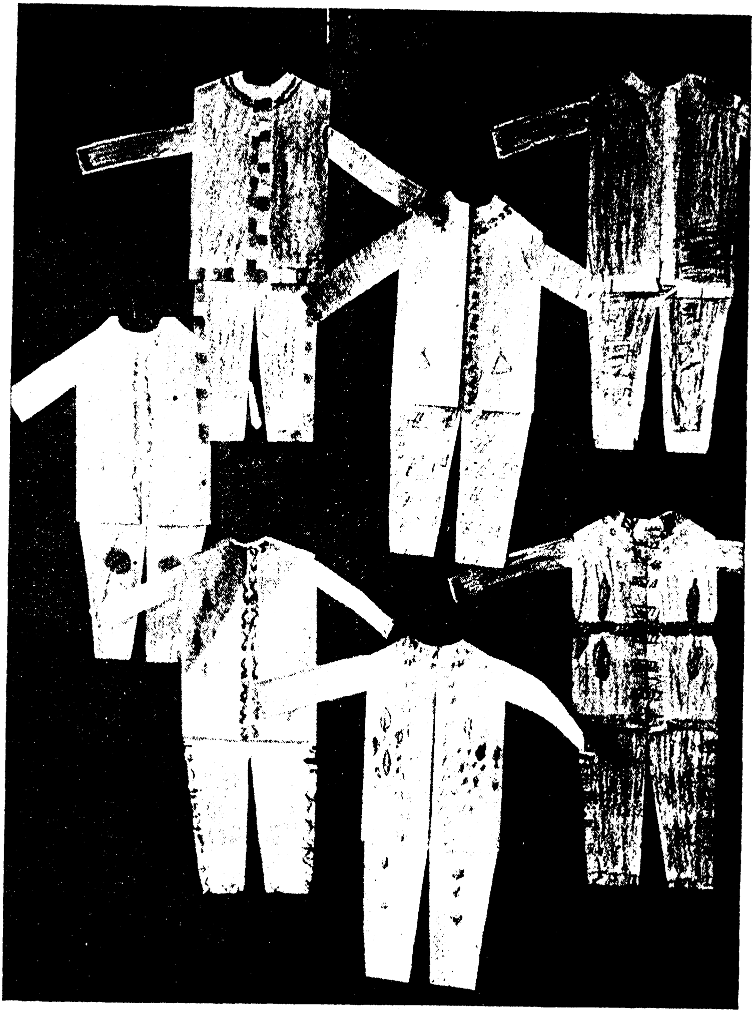


FIG. 43. Indian Costumes Made by Children of a Third Grade

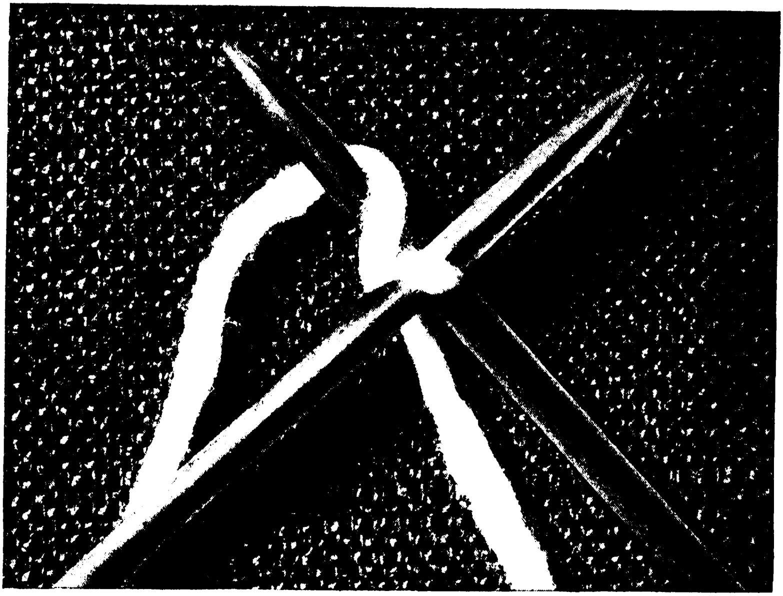


FIG. 44. First Step in Casting on Stitches for Knitting

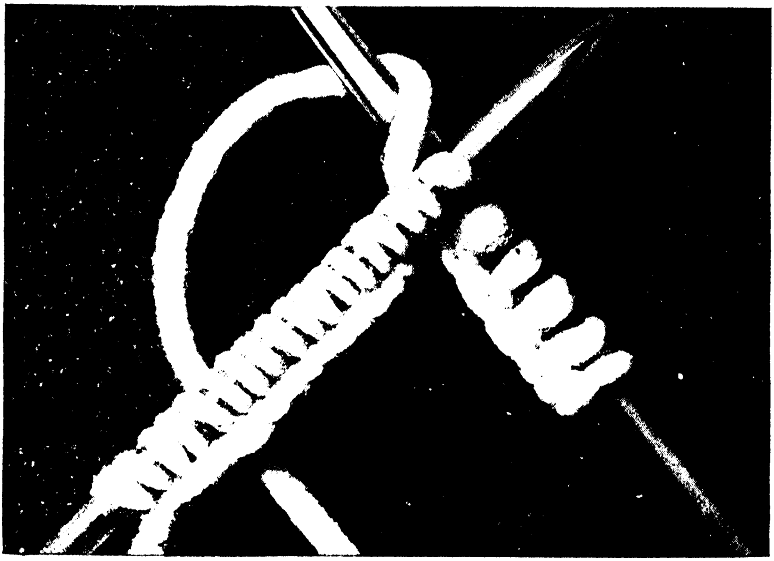
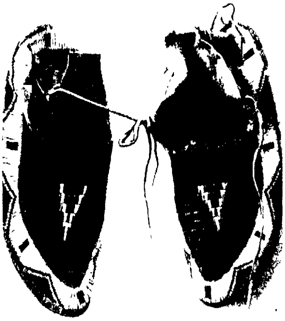


FIG. 45. Plain Knitting

made. Figure 47 gives a suggestion for a pattern. The children may find it worth while to list all the uses they can name for which the Indians found skins suitable. The use of beads in leather work proves an interesting feature related to the consideration of skins. Some accounts of Indian methods will give instances of Indian women who resorted to chewing the skin to soften it into a suitable leather. Travelers to Alaska report Eskimo women with teeth sometimes worn to the gums, due to this way of making leather.



Courtesy American Museum of Natural History

FIG. 46 Sioux Indian Moccasins

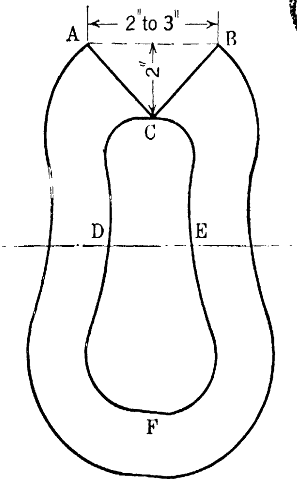
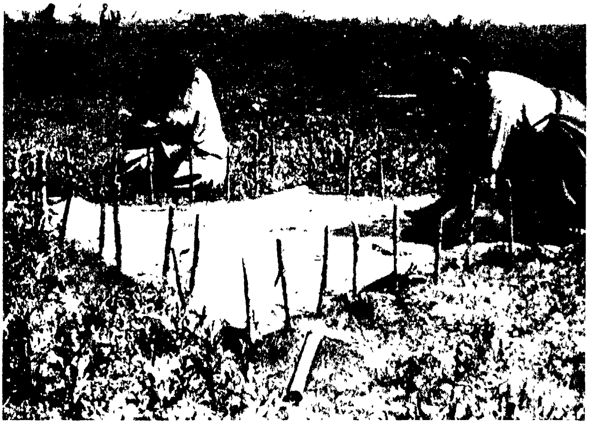


FIG. 47 Pattern for Making a Moccasin

Noting other methods used by the Indian woman in decorating clothing. Another method of the Indian woman in decorating her textiles is not so commonly known as her weaving devices, although the process is used much to-day in the art crafts. This is the tied-and-dyed process of decorating a cotton or silk textile.

A simple understanding of it can be secured by dyeing a textile by this method. Select a piece of white cheesecloth or China silk. Hold the cheesecloth by the center. Draw it down smooth. About one or two inches down from the center wrap the cloth tightly with twine many times around. A little lower down, wrap again, and repeat with a third wrapping. Wring the cloth out of cold water. Put in the dye bath. After dyeing allow the cloth to dry. Remove the strings and straighten the material. A design of irregular concentric circles will be obtained. The children will suggest many varieties in design and in the use of two colors.



Courtesy American Museum of Natural History

FIG. 48. Removing the Flesh from a Skin Preparatory to Making Leather

Sometimes the Indian woman made patterns of desired shapes by running a needle and thread in a running stitch along the line or figure of the intended design. Drawing up the thread tight and wrapping it several times before dyeing made it possible to get the desired pattern. Another method was to wrap strands of the thread at intervals and then dye the thread. When woven into cloth it made a mottled pattern.

There are examples in the American Museum of Natural History of both the fabric and the thread method of tied-and-dyed design as done by the American Indian woman.

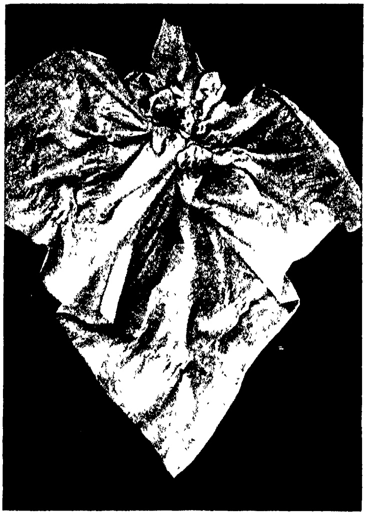


Fig. 49 Sewed and Partly Tied for Dyeing

Finding how the Hebrews dressed. Bible stories and accompanying pictures will suggest much about the clothes of the Hebrews. Why was white worn so much? What fiber was used for making the white cloth? Why did they not wear skin garments? What use did they make of skins? Where did the Hebrews get dyes for such garments as are suggested by Joseph's coat of many colors? What did they wear on their feet? Why were these removed on entering the house?

Similar investigations concerning the clothing of the Eskimo may be profitable by way of giving judgments of the

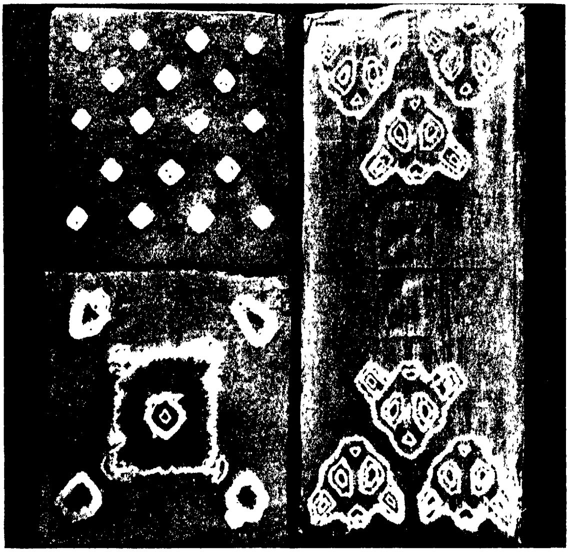


FIG. 50 Tied-and-Dyed Designs

worth of our methods through comparison with the methods of other people.

Desirable outcomes in Grade III.

1. A rather definite knowledge of the essential characteristics of the wool fiber.
2. An understanding of how to wash wool and why.
3. An understanding of the fundamental elements in making wool into cloth — carding, spinning, and weaving.
4. A beginning of interest in Indian design, woven and dyed, with some knowledge of colors used.

5. An understanding of the heddle principle in weaving.

6. The beginnings of appreciation of handmade textiles of colonial and Indian make.

7. An interest in dyes.

8. Some limited ability to recognize wool by feeling, untwisting, breaking, and burning tests.

9. An interest in protecting woolen garments from moths.

10. An interest in design in woolen textiles.

11. Information about darning holes in knitted garments.

GRADE IV

Finding the characteristics of silk fabrics. The children use silk hair-ribbons and neckties and know in an indefinite way that silk dresses are not worn for all occasions. Some knowledge as to the reasons for this may be had. A little consideration of prices of silk fabrics may be worth while. Collect samples and prices and compare with samples of cotton and woolen fabrics. The difficulty of keeping clean will be apparent. Many children know that silk dresses may be dry-cleaned and that an occasional silk fabric is known as *tub silk*. Advertisements of laundry preparations suitable for silks may be familiar. Make estimates of the number of times a cotton dress may be washed before it is worn out. Find how many times a silk dress may be cleaned. Such summing of available experience about silk will lead the children to realize its relative delicacy.

Studying the processes involved in producing silk fabrics. One may be able to secure cocoons from a silk manufacturer. If the school is situated where it is possible, it would be better to get some worms that are ready to spin their cocoons. A still better method would be to write T. Keleher, 662 Massachusetts Avenue, N. E., Washington, D. C., for a small quantity of silkworm eggs in the spring when the mulberry tree is budding. If the mulberry is lacking, the leaves of the Osage orange may be substituted. Lettuce may be used in the early stages of the worm's development. Place the eggs in a temperature of 55° Fahrenheit. From the fourth day on, gradually increase the temperature to 73°. Hatching will occur in about ten days. Place the young worms in trays in a room kept at the hatching temperature. Place near them the mulberry leaves corresponding in age to the age of the worms. This correspondence in age should be continued in feeding. Be careful not to feed damp leaves. About five or six days after hatching, the worm stops eating and becomes restless until it finds a convenient place to attach, where it molts. Then it resumes eating. The second molting is four days later; the third, four or five days later; and the fourth, five to seven days after this. Then in from seven to twelve more days it begins to spin its cocoon. This latter process requires about seventy-two hours.

Find out how the Chinese raise silkworms. Perhaps some silk factories will send exhibits showing the stages in the process of producing silk. These will suggest to the children that they try to get the silk from the cocoon and make it into a thread.

Save some of the cocoons in order that the butterflies may later come out and lay eggs, thus completing the cycle. Put the remaining cocoons into boiling water. After they have soaked a short time to soften the gums, use crochet hooks in teasing them until the end of the fiber is found. Give each cocoon, so teased out, to a child who is to endeavor to pull out the fiber. This will quickly teach the delicacy of the silk fiber. As the fibers are drawn out several inches, a reel will be needed. Attach a bent wire to one end of a spool to serve as a crank. Put the spool on another wire as an axle. Wind four fibers at a time on the spool, twisting them as they are wound. Do this for several sets of four fibers. Then reel four sets of four on one reel, thus making a sixteen-fiber thread. Combining again will make a sixty-four-fiber thread.

One group of children went farther, improvising a small loom by nailing a fine-toothed comb at each end of a block of wood so that the teeth extended above the wood. Then they stretched some of their silk thread back and forth across the teeth for warp threads and carefully wove in the remainder of their thread, thus producing a small piece of silk fabric, all their own work. Of course such a task is very fine and only a little should be done at a time, lest it be too great an eye strain.

Finding out how silk may be loaded. Get a sample of undyed Chinese silk and a piece of cheap taffeta ribbon. Hold a lighted match to the Chinese silk and notice the flame with which it burns. Notice what is left — only a crusty substance somewhat like the burned head of a match. Try the cheap taffeta ribbon. If a very poor quality, it will not flame at all -- only smolder. Note what is left — a charred " wire-screen " piece, sometimes even showing the mesh of the textile. The explanation is interesting. In experimenting with dyes it will be recalled that salt is used to set the color. This salt is the salt of a metal — sodium. Salt of tin is often used by men who dye fabrics. When salt is put into a bath for dyeing silk, the fiber has a wonderful affinity for the salt. If enough salt is used, the silk fiber will take up so much that it is loaded with the metal. Notice how stiff cheap taffetas are. This will explain why there is no flame seen when loaded silk is burned.

A merchant said, " No, we don't carry taffeta silk slips. They wear out too soon." See if the children can explain why. See if they can suggest why one so often hears of silk sales.

If a piece of stiff taffeta is burned in an inclosed vessel so that no dust or ash or wind can interfere, some interesting results may be found. The residue looks, if not crushed by careless handling, quite like a fine-meshed wire screen. Weighing before and after burning shows that some relatively high-priced taffeta is forty per cent loaded.

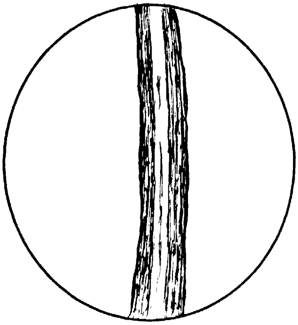


FIG. 51 A Silk Fiber as It Looks under the Microscope

Looking at a silk fiber under the microscope. Borrow a compound microscope and place a silk fiber fresh from a cocoon under the field of vision. Do not be misled if you chance to see a mass of gummy substance. The fiber will look somewhat like this. The dim partition down the middle is due to the fact that the fiber is secreted by two glands in the worm's body. The two secretions unite before coming to the surface as a single fiber.

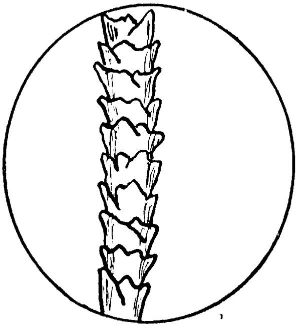


FIG. 52 A Wool Fiber as It Looks under the Microscope

Comparing cotton, wool, silk, and flax under the microscope. Some one will suggest looking at the other fibers while they have the microscope. Use fibers in native condition lest adulteration so change the fibers as to give one a wrong notion. The illustrations show what you should see. The children may have seen the wool fiber in the third grade.

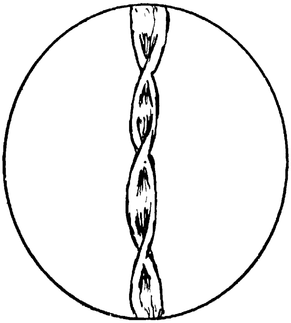


FIG 53 A Cotton Fiber as It Looks under the Microscope

See if any of the children can recall how wool should be washed. What do they think felting is? Why do much-rubbed baby-flannel petticoats become stiff? Boiling the wool weakens the structure of the joints of the wool so that they tend to "telescope" more. This explains why woolens shrink. How, then, should woolens be cared for? How should soap be applied? Is the plunger washing-machine good for woolens?

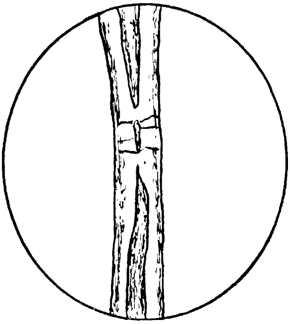


FIG 54. A Flax Fiber as It Looks under the Microscope

From what the microscope shows, can the children see why the cotton fiber is curly? Why not use the milkweed fiber? It is as long as the cotton fiber and beautifully glossy. Can any one suggest how the cotton fiber is mercerized? Consult an encyclopedia or a book on textiles. What does the twist to the fiber have to do with it? The steps in mercerization include, first, the process of singeing the cotton fabric by running it through electrically charged rollers to remove the fuzzy ends that stick out. Then the fabric is carried by rollers into a water bath to put out chance sparks. From here it is carried by rollers into a bath of either caustic soda or caustic potash. This softens the structure of the cotton fiber and tends to straighten it, at the same time adding luster. From the alkaline bath it goes into a solution containing sulphuric acid to neutralize the alkali. Then it is rolled into rinse baths and passed through mangles, coming from these a shimmering textile. Will the shimmer disappear with washing? Compare such cloth with that which is made glossy by subjecting to pressure which irons it smooth. Will it lose its gloss? See if the children can get samples of shimmering cloth which seem to be mercerized cotton. Wash them to see which is truly mercerized. Which should be the more expensive? Which is?

What function do you think the "joints" or knots in the flax fiber perform in making a fabric? Can you suggest why flax fibers do not need to be twisted so hard?

Learning to distinguish the animal from the vegetable fibers. Burn some wool. Burn some silk. Is there any resemblance? Burn some feathers and note the odor. Note the tendency of burning wool and silk to form a crust. Burn the end of a piece of cotton twine. Burn the ends of flax fibers and linen threads. Note the odor. Note the stubby ends. Burn the ends of an old straw broom. Note the same stubby appearance. Summarize what you have found out by these tests.

If one burns a piece of cloth to see if it is all wool, will he get the answer? How much will the test tell?

Finding out how the American colonists provided clothing for themselves. When the children are studying the history of colonial life, it is a good time to consider colonial household industries. We live in an age of factories, but the essential processes are the same as were used in making things by hand. To study the hand process helps in studying the more complicated machine process. The things the colonists did in providing clothing, by comparison, give a basis of understanding how we should meet our problems.

They made use of skins for clothing. The stories of colonial life which the children will be reading will make quite familiar to them the frontiersman, dressed in his leather hunting-shirt, buckskin trousers, and coonskin cap. The children will be interested in finding how leather is made.

Finding what leather is. In Grade II was suggested a way of drying and salting a skin to preserve it and make it usable. A skin so treated becomes known as *tawed* leather. In Grade III, it was suggested that the children find out about the Indians' use of skins. In the work in geography in Grade IV, much attention is given to tracing products, familiar to the child, to their sources, while the work in industrial arts may well give an acquaintance with the processes of making the manufactured articles. Thus, how people live and what people do are closely tied with the processes of supplying our needs.

In this grade the supplying of shoes makes a good unit of study. Tracing the shoes to the factory leads to the question of the source of the leather which is used. This calls for some understanding of what shoe leather is and how it differs from the tawed leather already studied. To make tanned leather requires the use of tannin. The process may be carried out in varying degrees of complexity. A very simple method is possible in an ordinary school situation. This produces a leather approximating the qualities of leather as children know it.

The objectives in tanning are to give strength and durability, to make the skin impervious to water, and to keep the skin from decaying. Secure a piece of cowhide. Wash and soak in water to cleanse. Place in lime water and allow it to remain for a week. Remove and rinse. The hairs will be found to be loosened so that they can be pulled out. Scrape off all pieces of flesh and loose membrane. Wash in a bath of boric acid to neutralize the lime, or wash freely in soft water. Prepare the tannin bath by bruising and crushing oak bark and leaching it by pouring boiling water over it. Put the skin in this liquor when cooled — a weak solution at first, which is gradually increased in strength. Keep the skin in this for a week. Dry and curry, or soften, by rubbing. A small amount of fat may be rubbed in to aid in softening.

Collecting samples of different kinds of leather. The children will by this time have become interested in reading in books of reference about different kinds of leather processes and will probably bring in samples of different kinds of leather. Compare the kinds of leather found in shoes, gloves, footballs, harness, hand bags, suitcases, and other objects made of leather. Find as many as possible of the uses made of leather at the present time. An interesting summary of the results can be made in chart form, including the samples collected and illustrations of processes. Sometimes the manufacturers of leather goods will be glad to assist in this by sending the children samples. Boot and shoe houses at times have been known to send samples illustrating the steps in making shoes. Consult the World Almanac to secure data for charting the facts about the leather industries, the uses of leather, the countries producing skins, the countries manufacturing leather and leather goods and leather substitutes, the relative importance of the United States in these industries, and kindred details.

An interesting outgrowth of this may be the collection of pictures, descriptions, and samples of shoes of various nations.

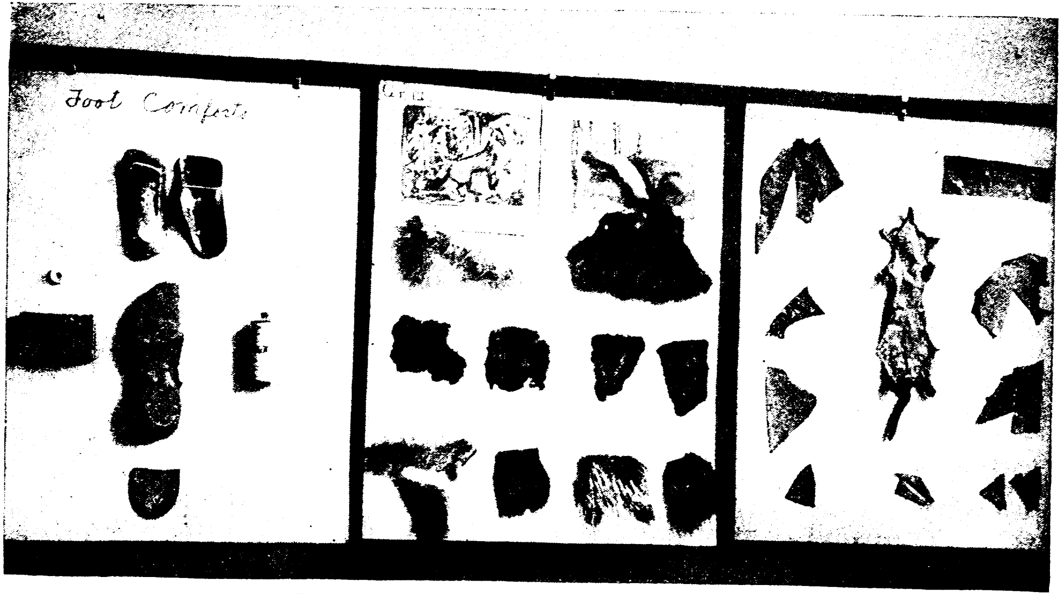


FIG. 55. Charts Made in the Study of Leather

The study of skins should include the use of skins for water bottles, mentioned on page 305, and the making of parchment for writing material, mentioned on page 365.

Finding out how colonial mothers spun their thread for cloth. Alice Morse Earle's books give very interesting data upon spinning and other household industries. Gather pictures of the different kinds of spinning wheels that have been used. They are of two general types. The flax wheel was a low wheel at which grandmother could sit and spin because it was easily run by treadling. She could sit in a warm corner by the fireplace and spin for a long time without becoming too tired. This wheel is characterized by the distaff standing out in front, around which was loosely twisted the flax fiber which other members of the family had prepared. She could spin wool on this wheel also. Often she could be seen spinning with a chair piled high with the snowy slivers made by hands skillful in using the cards. See page 139.

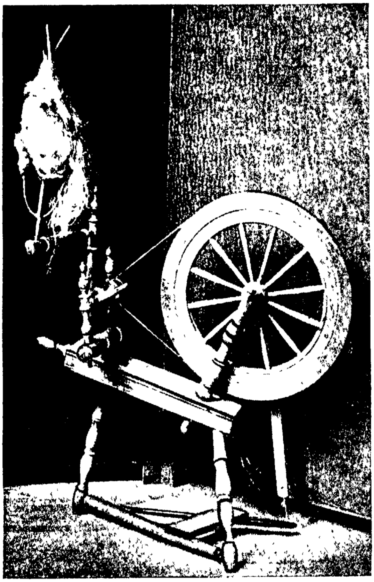


FIG. 56. The Flax Spinning Wheel

The wool wheel was a tall, three-legged, awkward thing, very much in the way except when in use. To spin on this wheel a young, active girl was needed. She placed the chair, piled high with the slivers, near the spindle head of the wheel. Picking up one sliver in her left hand and holding the end of the yarn on the spindle in the right hand, by a deft twist of her fingers she attached the end of the sliver to the end of the yarn. Then with her right hand she gave the wheel a whirl, at the same time stepping backward to stretch the sliver as it twisted. When she had gone back as far as desired she whirled the wheel in the opposite direction, thus winding the yarn just made upon the spindle. Some women were very skillful, being able to stretch the sliver and spin it into a longer thread than others. Alice Morse Earle[1] tells of one Mistress Mary Prigge who spun a pound of wool into fifty hanks of eighty-four thousand yards -- nearly forty-eight miles. Buy a skein of yarn. Weigh it. Measure its length. Calculate on a basis of its weight and length how far a pound of it would reach.

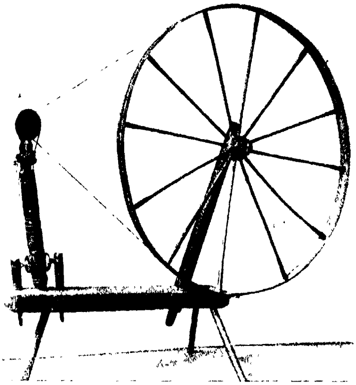


Fig. 57 The Wool Spinning Wheel

" Ordinarily it was a good day's work for a quick active spinner to spin six skeins of yarn a day. It was estimated that to do that with her quick backward and forward steps she walked over twenty miles a day." [1]

---

[1] Earle, Alice Morse.—*Home Life in Colonial Days*, p 102 Macmillan.

It is very evident that a good spinner would have her slivers the same size and would try to stretch them the same amount to insure yarn of a uniform size. In this way she would tend to fall into a rhythm in her work. Read these lines and see if the children can catch the rhythm of the movements made by this spinner:

> A white pine floor and a low ceiled room,
> A wheel and a reel and a great brown loom,
> The windows are out and the world is in bloom —
>
> A pair of "swifts" in the corner, where
> The grandmother sat in her rush-wrought chair,
> And pulled at the distaff's tangled hair;
>
> And sang to herself as she spun the tow,
> While "the little wheel" ran as soft and low
> As muffled brooks where the grasses grow
> And lie one way with the water's flow.
>
> . . . .
>
> The "great wheel" rigged in its harness stands —
> A three-legged thing with its spindle and bands, —
> And the slender spokes, like the willow wands
> That spring so thick in the low, wet lands,
> Turn dense at the touch of a woman's hands.
>
> As the wheel whirls swift, how rank they grow!
> But how sparse and thin when the wheel runs slow
> Forward and backward, and to and fro!
>
> There's a heap of rolls like clouds in curl,
> And a bright-faced, springy, barefoot girl.
> She gives a touch and a careless whirl,

---

[1] Earle, Alice Morse — *Home Life in Colonial Days*, p 198. Macmillan.

She holds the roll in her shapely hand
That the sun has kissed and the wind has fanned,
And its mate obeys the wheel's command.

There must be wings on her rosy heel!
There must be bees in the spindled steel!
A thousand spokes in the dizzy wheel!

. . . .

It is one, two, three — the roll is caught;
'Tis a backward step and the thread is taut,
A hurry of wheel and the roll is wrought!

'Tis one, two, three, and the yarn runs on,
And the spindle shapes like a white-pine cone,
As even and still as something grown.

The barefoot maiden follows the thread
Like somebody caught and tethered and led
Up to the buzz of the busy head.

With backward sweep and willowy bend
Monarch would borrow if maiden could lend,
She draws out the thread to the white wool's end.

. . . .

With her one, two, three, the wheel beside,
And the three, two, one of her backward glide,
So to and fro, in her calico pride
Till the bees came home and the day time died!"[1]

Listen to the Victrola Records No. 64921 and No. 18598 and decide which of these two spinning songs represents the little flax wheel and which the big wool wheel.

Making a collection of pictures, poems, stories, and songs about spinning and weaving. Encourage the children to look through books of poetry, song, and story and see how many selections can be found about spinning. Let them collect all the pictures they can of scenes in which there are spinning wheels or looms.

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[1] Anon. — "The Spinning Wheel," in Bryant, W. C. — *Family Library of Poetry and Song*, Holiday Edition, p. 498.

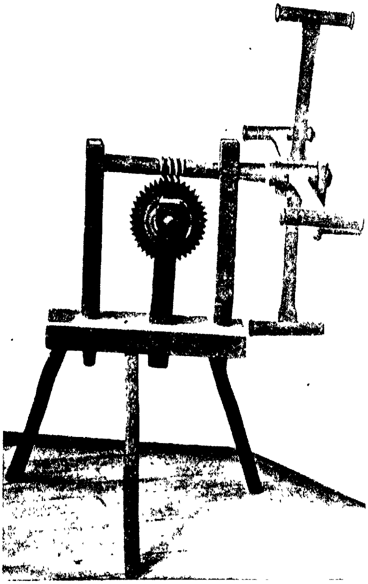


FIG. 58. The Reel for Winding the Yarn from the Spindles into Skeins

There may be in the community a woman who will spin for the children. If so, the children can well afford the time it will take to go to see the process.

Examining a colonial loom. By this time enough of the weaving problems will have been met to make a colonial loom meaningful. Take the class to see such a loom in use, if possible. Note the beams upon which the long warp threads are wrapped. See if the children can identify the heddle device used. Show how the treadles manipulate the heddles. Note the batten and its work. See what is used to keep the edge straight instead of the wires used in making the community rug.

Finding out how grandmother dyed her clothes. Recall the work done in studying dyes in the third grade. While considering the household industries of colonial days, a little attention should be given to the problems of dyeing rags. Look in such books as Calvert Hall's *Handwoven Coverlets* or Alice Morse Earle's *Home Life in Colonial Days* to find what materials were used for dyes. Ask some of the old people in the community what they were told about vegetable dyes. Consult the encyclopedia for suggestions. See also page 149 of this book, about materials that can be used. Prepare some rags for weaving, dyeing them the desired colors, using the vegetable dyes procured or prepared dyes. What are the advantages in using commercial dyes? Can you think of any reason why one might use vegetable dyes to-day? How do you "set" the color so that it will not fade?

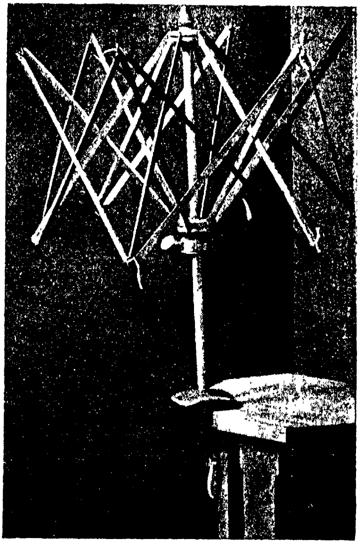
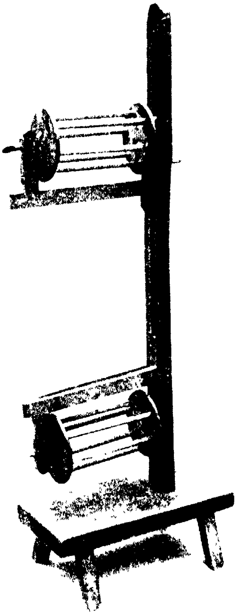


FIG. 59 Colonial Swifts Used in Handling the Skeins when Preparing for Threading a Loom

Making a rag rug. A loom can be made after the plan shown in Fig. 24, except of larger dimensions, placing it on legs as in Fig. 62. To keep the edges of the rug straight, long stiff wires can be placed through eyelets so that they mark the edges of the rug. In weaving, the woof, or weft, thread passes around the rod each time. By attaching the rods through eyelets, one can remove them as the rug is finished.



Courtesy Metropolitan Museum of Art

FIG. 60 Barrel Swifts

Broomsticks or "dowel" rods an inch or more in diameter should be used for the beams to hold the warp.

The rugs can be woven by the children, working at odd moments, using the rags dyed in experimenting with dyes.

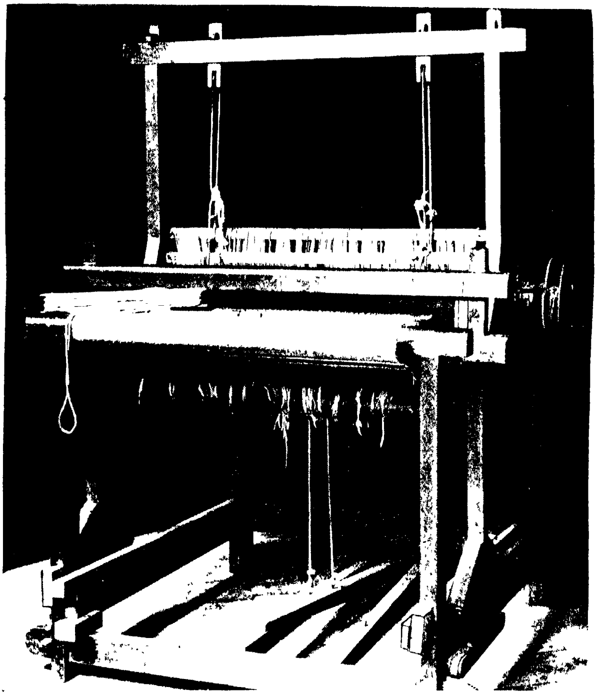


FIG. 61 A Colonial Loom

Note how this loom in Fig. 62 approximates the essentials of grandmother's loom.

Finding out the characteristics of Greek clothing. Find Greek myths and stories which contain references to the clothing of the people and to the processes which were used in making the garments, such as the story of Penelope's weaving. Read and compare these various accounts and thus find out the kinds of garments worn. Collect copies of pictures about the Greeks and pictures of Greek statuary. Compare the clothing in these with the clothing described in the stories. What do you think were the occupations of people so dressed? Who did the work needed to provide the necessities of life? How were they dressed? What do the clothes in the picture of Alma-Tadema, entitled "A Reading from Homer," tell you about the three people in the picture?

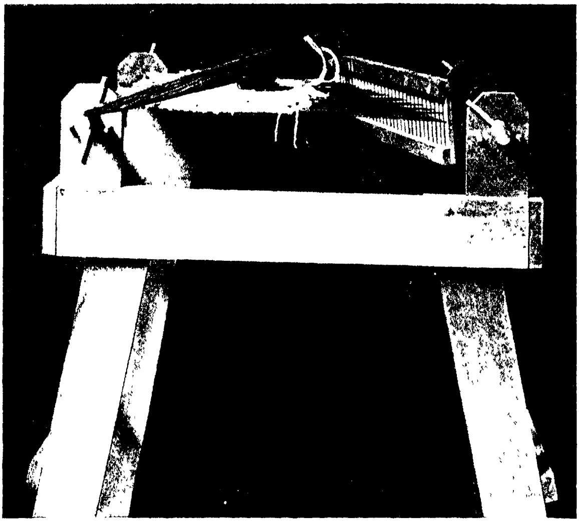


FIG. 62. A Loom for Weaving Rugs, Made in School

A study of Greek clothing will be needed in making costumes for dramatizing Greek stories from history or literature. What are the outstanding characteristics of

Greek garments? Examining pictures leads one to note the flowing lines and moderate curves. The lack of stiffness either in material or line suggests freedom, airiness, joy, life. The fullness of the garments likewise indicates freedom and plenty. The evident limitation in decorative elements suggests that to the Greeks simplicity was an element of beauty.' Note the subordination of such decorative elements as are used.

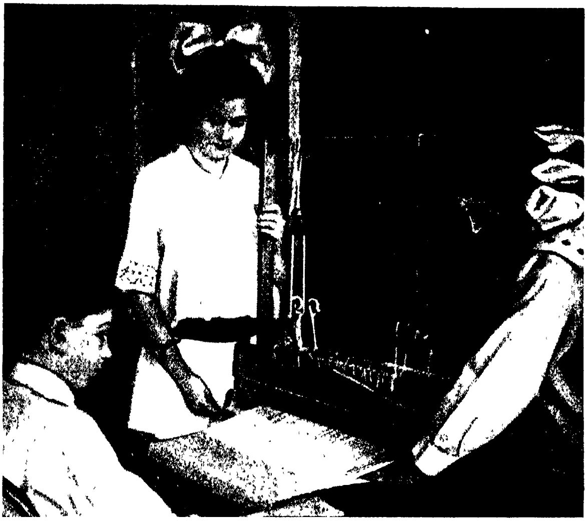


FIG. 63. Using a Rug Loom

Note the shuttle being put through the shed.

Finding the characteristics of Roman clothing. Make a similar study of the clothing of the Romans to find the characteristic types. What was the significance of the toga? What was the costume of the Roman soldier? Can you find anything about the Roman stripe?

Finding out about rubber as used in clothing. A list of the uses of rubber in clothing and accessories will include rubbers, overshoes, boots, coats, hats, bathing caps, rubber gloves, elastic garters, suspenders, arm bands, and rubber combs. The particular values of rubber for these uses should be noted, as protection from rain and snow provided by coats, hats, and shoes, the flexibility of elastic garters and suspenders, the prevention of slipping by rubber shoes and heels, and the prevention of bodily shocks in walking by rubber heels.

While studying rubber for these purposes, one may also note other uses of rubber, to indicate how extensively rubber enters into present-day life. Examples found will include rubber tires, rubber hose, hot-water bags and ice bags, erasers, rubber bands, toy balloons, rubber roofing, rubber sheeting, and, in its hard form called *vulcanite*, rubber combs, fountain-pen barrels, phonograph records, pipe stems, and various other products. Find from a textbook in geography where rubber is produced and from where the United States gets most of its rubber. Read an account of work on a rubber plantation. Write to some rubber company for information about the production of rubber.

On his second voyage of discovery to America, Columbus found that the Indians had large black balls which bounded high in the air. For a long time, the only use made of this substance by Europeans was that of rubbing out pencil marks. It was therefore called rubber, and because it was first found by the Indians it was also called Indians' rubber, and later, India rubber. Spanish explorers in Mexico found the natives making shoes of rubber. By smearing the rubber gum over their canvas coats, the Spaniards found that these coats shed water.

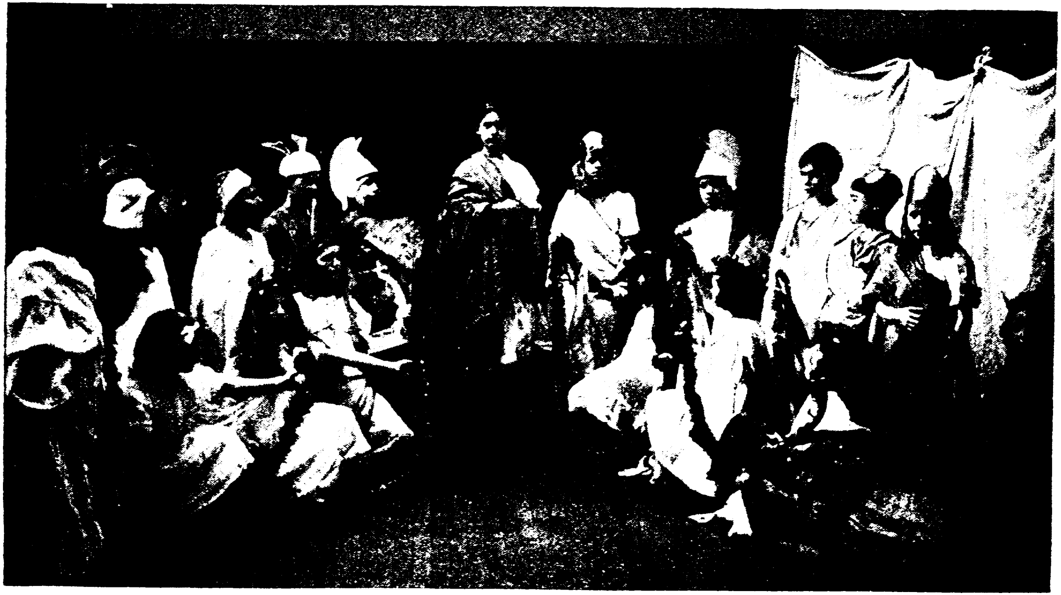


FIG. 64. Costumes Made by Fourth-Grade Children for a Greek Dramatization

About 1823, Macintosh, a Scotchman of Glasgow, used rubber for making waterproof coats. He was not very successful, as the rubber melted when it became very warm, or became hard and cracked when it got cold. However, his name is still used for certain kinds of rubberized coats which we know as mackintoshes.

Charles Goodyear of New York State finally found out how to treat rubber with sulphur so that it would neither melt nor break with changes of temperature, and so made possible the many uses which we have for rubber to-day. This process, invented by Goodyear in 1839, is called *vulcanizing*. He experimented for ten years before he succeeded in finding a way to make rubber in the form in which we know it as a finished product.

Desirable outcomes in Grade IV. From this work the teacher should expect:

1. A knowledge of some of the uses made of skins by the colonists.
2. A rather definite notion of what leather is.
3. A knowledge of the varieties of leather and some notion of the various animals whose skins are used in making leather.
4. Some notion of the importance of the leather industry and the countries which lead in its production.
5. An understanding of the spinning process and ability to distinguish the wool wheel from the flax wheel.
6. Some appreciation of the rhythm of hand spinning.
7. More interest in the dyes of to-day as compared with the dyes of colonial and pioneer days.
8. An understanding of the essentials in a colonial loom.
9. A clear idea of the silk processes.
10. An interest in the life cycle of an insect.
11. Knowledge of the microscopic structure of the four fibers and the implications for the various fabrics.

12. Some ability to judge values of fabrics in terms of work done in making them.

13. Better ability in discriminating the four fibers and their fabrics.

14. Knowledge of the uses of rubber and of what rubber is.

GRADE V

The geography of the fifth grade usually includes a rather intensive study of the various regions of the United States, emphasizing the activities of the people as related to the conditions set by the geographic controls of these regions. A study of what people do is quite prominently a study of the industries. Here the work in geography connects very closely with the work in industrial arts. In this grade particularly do the two meet. Many of the regions cannot be fully appreciated without the contribution of industrial arts. In many cases the answers to the questions raised are as much geography as industrial arts – often both. It is not important in which subject the work is done, but it is important that the work be done. In this particular unit some things are suggested which are in part geography.

Finding the importance of the wool industries. The sheep ranch life is a prominent element in studying certain sections of the western states. Find out the details of the methods of caring for the sheep and conducting the sheep shearing. Read Chapter V of Helen Hunt Jackson's *Ramona.* Compare with the methods of producing wool in colonial days and in Bible times. Notice the loss of personal interest once taken in sheep.

Follow the wool from the ranch to the store through the factory. Read *From Wool to Cloth*, sent upon request by the American Woolen Company, Boston, Massachusetts. Compare these processes with the hand processes of colonial days.

From the World Almanac, or a similar publication, get data as to the amount of wool produced by the various countries. Make graphs showing these amounts relatively. Do this for 1913, 1918, and 1923. Note the effects of the war upon wool production. Find the prices of woolen products for these years and compare with the amounts of production. Find the total production last year by all countries. Find how many pounds each person would receive as his share if it were distributed equally among all peoples; among the peoples having winters cold enough to need wool. From what countries does the United States receive wool?

Finding the importance of the cotton industries. Write the children of a fifth grade in the cotton growing section of the United States and ask for an exchange of materials and descriptions, the children of this school describing and illustrating a local industry and the children of the cotton states sending information and illustrative material relative to the cotton industry. Make a collection of pictures relative to cotton. Chart and graph the data relative to the important cotton states and countries. Secure a pound of cotton in the boll. Dividing it among some of the children, have them see how long it will take to remove the seeds. Compare with statements in histories regarding methods used before the invention of the cotton gin. See page 130.

Send to some textile mills for advertising materials and samples of the various stages of the material in spinning. Compare with the hand processes of making thread. Trace the cotton from the field through the mill to the store where it is sold as a fabric or garment. Weigh a quantity of bleached muslin and find its selling price. Find the price the planter receives for the cotton. Find how much is added for factory work, middle men, selling, and profits. An exhibit of cotton from field to finished products may be borrowed for one week from the Wamsutta Mills, New Bedford, Massachusetts.

Trace the history of attempts to devise a machine to gin cotton. Explain the significance of Eli Whitney's invention. Find out what is being done to perfect a cotton-picking machine.

Make a list of all the things the children can mention made from the cotton plant. Consult government publications.

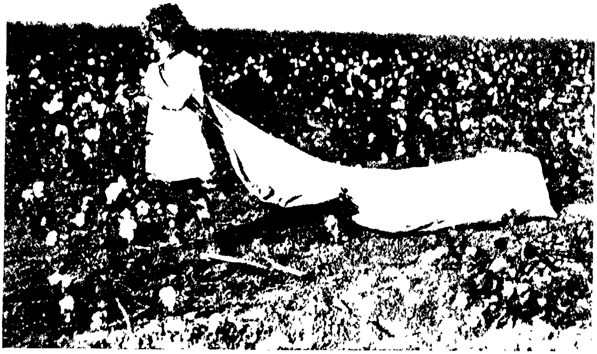
Finding out the prominence of the flax industries in the United States. From data available in geographies and the World Almanac find the production in the United States of flax for fiber and of flax for seed and oil. Compare these figures with the corresponding production in other countries. What are the linen-producing countries?

Find out where hemp is produced. Read the description of hemp fields in James Lane Allen's *The Reign of Law.* What other textile fibers are somewhat like flax and hemp?

Finding the prominence of silk growing and manufacture in the United States. Gather data on silk production in the United States. Find how much silk is imported raw and manufactured. Consult government publications to find out what has been learned relative to producing silk in the United States. What conditions are essential to success in this occupation?

Explaining the location of our textile cities. Make a list of all the prominent textile factory cities in the United States. Have the children write to some of the commercial clubs in these cities and see if they will send them advertising materials which include an account of the beginnings and growth of the textile industries. From these sources and industrial histories explain the causes which located the textile cities. Many of these cities are remote from the raw materials.

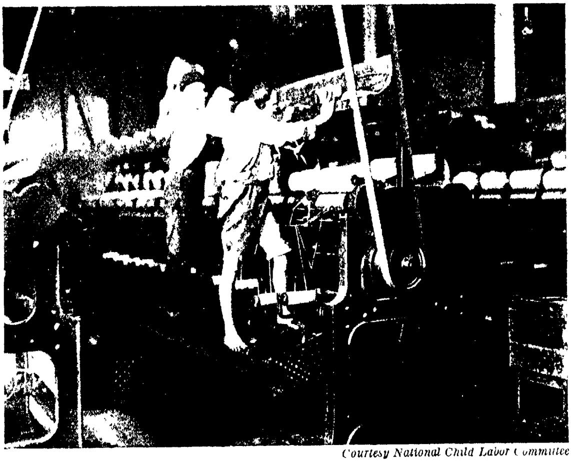
Finding out what the lives of textile workers are in textile towns. Gather such information as you can about the lives of textile workers, the number of women employed, the age at which a child can be employed, the hours of work, etc. Consult recent magazine articles by means of the Readers' Guide, which is usually to be found in the city library.



Courtesy National Child Labor Committee

FIG. 65. A Very Youthful Cotton Picker

Considering values relative to the production of textile design. The accounts of factory processes will make some mention of the ways in which textiles are designed. Make a collection of textiles variously designed and classify them. There will be many with woven designs — stripes, checks, plaids, diagonals. Many will be found with printed designs. These are made by using a chemical to take out the color, thus leaving a white design. Find out how this is done. Compare blue and white calico with blue and white gingham in price and durability. Explain. Wash the two quite vigorously and see if any differences appear. Holes appear in blue and white print goods sometimes where the white is, because of failure to remove all of the chemicals used in printing the design.



Courtesy National Child Labor Committee

FIG. 66. Children Working in a Textile Mill

Find the prices of fabrics having an embroidery design. Explain the reasons for such prices.

Block-printing a textile. Connected with the study of textile design and with the block-printing in bookbinding it may be well to take time to make a design, cut the lino-

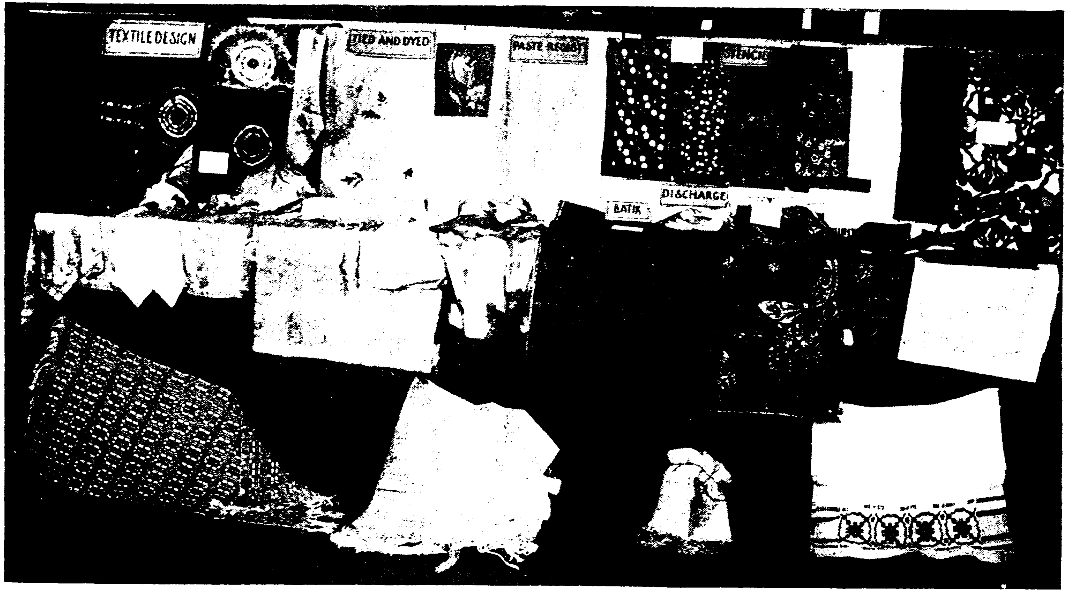


Fig. 67. Illustrating Various Types of Textile Design

leum block, and print the design upon some curtains, scarf, or other textile in which the children are interested. See block-printing, page 407.

Studying the batik process. In the stores one often finds very expensive textiles sold under the name of *batik* work. What makes them so expensive? A little insight into the process will help in judging values in this material. The process follows the same principle as the tied-and-dyed work of the third grade. It consists of dyeing the fabric with part protected — in this case by wax. The wax is later removed by ironing between blotters. A little experimentation in this process is justifiable if it helps to clarify ideas about textile fabrics. The history of batik work will be found of interest as an illustration of an old craft recently popularized in this country.

Desirable outcomes in Grade V. From this work the teacher should expect:

1. Some appreciation of the wool production of the world.
2. Some notion of the available supply.
3. Some judgment of relative values of wool and cotton.
4. Some appreciation of the economic value of the invention of the cotton gin.
5. Some understanding of the causes leading to the building up of an industrial city.
6. Some knowledge of the condition of the workers in textile mills.
7. Some judgment of quality of textiles, due to the method of designing used.
8. Some appreciation of good design.
9. Recognition and appreciation of block-printed textiles and of batik work.

GRADE VI

Getting an understanding of the dyeing industries. Summarize the work on dyeing in the previous grades.

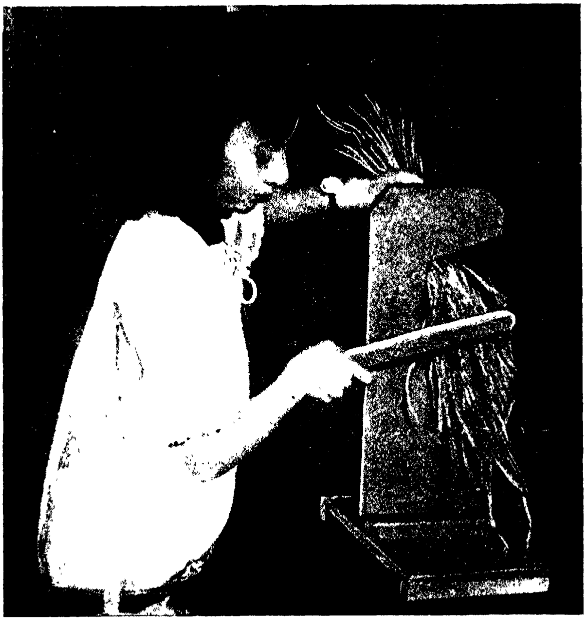


FIG. 68. Using a Scutch to Ripple the Flax

Through encyclopedias and other references find out what commercial dyes are. Find out all you can about coal-tar dyes. Consult a druggist for such information as he can give. During the war there was great difficulty because of the lack of German dyes. Consult the data in the World

Almanac as to our importation of dyes for the years from 1910 to the present. Make a curve graph showing the varying amounts imported. Are we again importing German dyes? From government publications and the Readers' Guide secure references giving information as to the status of American dye manufactories. Consult a dry-goods merchant about the difficulty of procuring textiles with fast colors.

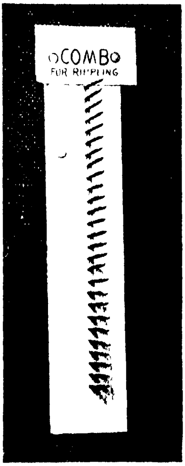


FIG 69 A Comb, Sometimes Used in Preparing Flax

Learning how flax fiber is produced for spinning. Buy some flaxseed. Plant it in the school garden. When it is in full blossom, pull it. It can be laid in rows in the garden and left for about three weeks to ret, or rot; or it may be taken in and placed in stagnant water for the retting process. When this process is completed, hang the flax up to dry. When it is dry, ripple it — thus removing leaves and blossoms. A *scutch* was sometimes used for this. It can be cut from a board into the shape of a mitten. Drawing the flax down over the edge between the thumb and fingers of the scutch removes the leaves and seeds. The next process is *breaking*. A break is made of wood somewhat like an accordion-pleating iron of two blades hinged together. The dry flax stalks are laid crosswise between the blades and broken by bringing the upper blade down upon the lower. This is repeated until the entire stalk is broken. The next step is *hackling*, removing the pith and the woody parts from the fiber. The sharpened spikes of the hackle are close enough together

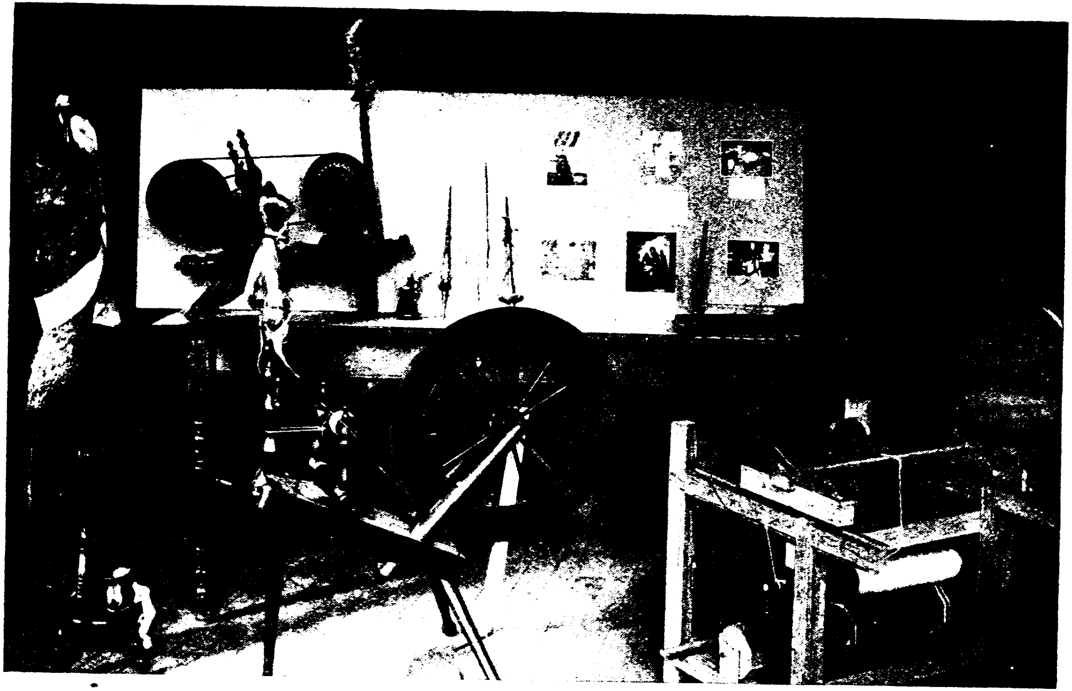


Fig. 70. Showing Several Ways of Spinning a Thread

to serve as teeth. Drawing the broken stalks over these spikes cleans the fiber of all woody matter. It is now ready to spin. If there is some woman in the community who can spin, take the flax to her and watch her spin it. If you are successful in this, try weaving a small piece of cloth for a doily.

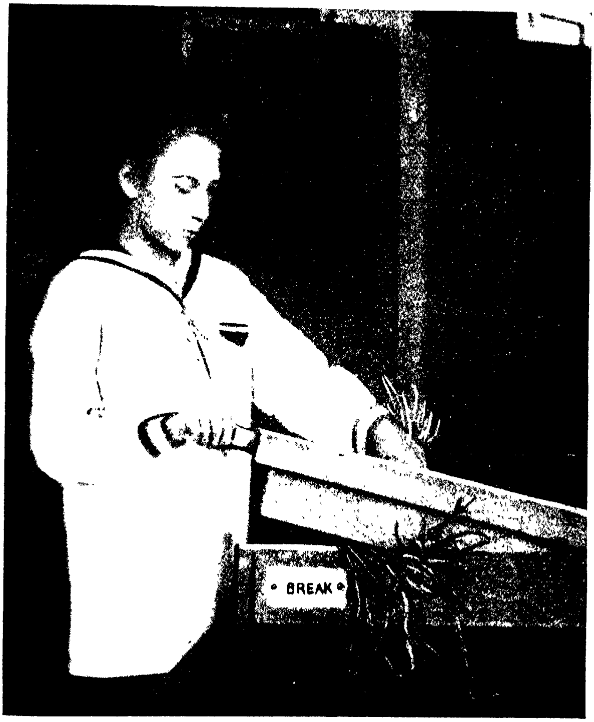


FIG. 71. Using a Break

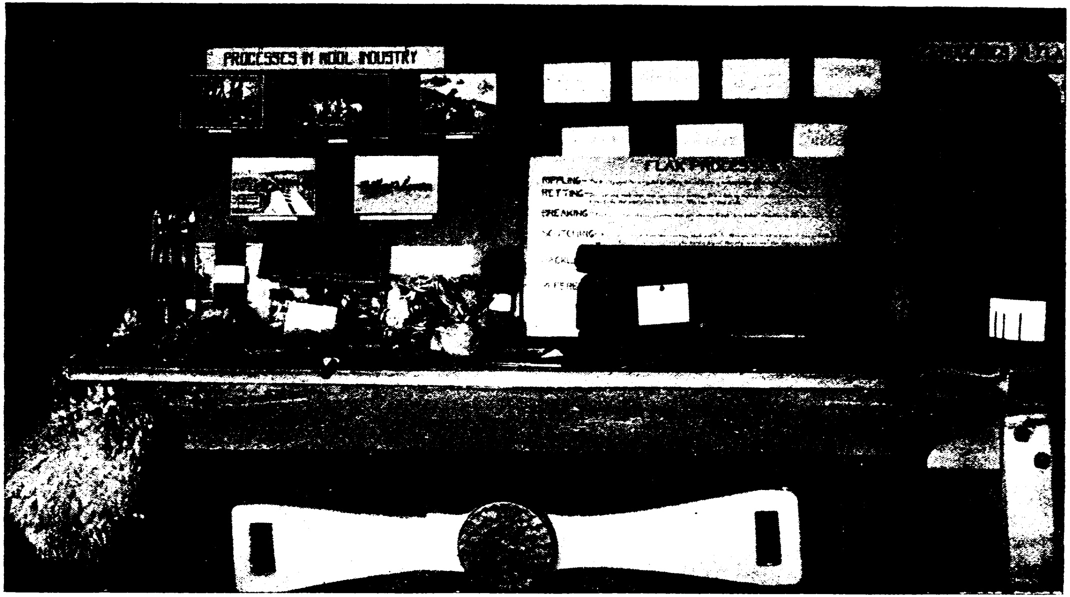


FIG. 72. A Summary of Processes of Preparing Flax and Wool for Spinning

Summarizing the ways of distinguishing the four fibers. Review all the different tests learned in the previous grades, feeling, untwisting, breaking, burning, and microscopic. There are a few other tests which will be helpful in discriminating where the ordinary tests are inadequate. There is the oil test, which has been recognized as an excellent test for discriminating cotton and linen. Let the children try putting a drop of oil on each of several pieces of cotton and of linen. Some of the more recent ways of manufacturing cotton to look like linen are such that the oil test is not sure.

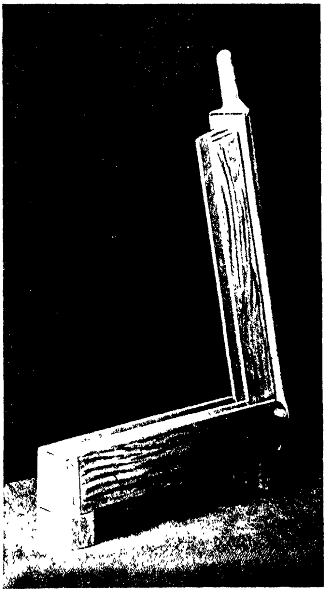


FIG. 73 Showing the Construction of a Break

Chemical tests are much more certain but are not safe for the children to make. They can be shown by the teacher. Perhaps the two best to use are the sulphuric acid and caustic soda tests. Place samples of the four materials in a dish containing sulphuric acid so that a part of each material lies in the acid. Place in the dish also a piece of cloth which is part wool and part cotton, letting it lie so that some of each warp thread is in the acid. Do the same with a cotton and silk mixture. Watch the results. Some fibers are affected more quickly than others. Try the same thing with a caustic soda solution. Tabulate the results.

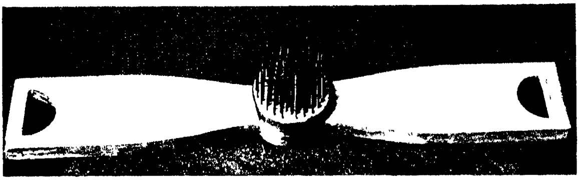


FIG 74 A Hackle Made by School Children

The worker sat, placing a foot in one hole and a hand in the other, pulling the flax across the hackle with the free hand.

It will be found that caustic soda or potash destroys the wool, has little effect upon the cotton, and destroys the silk more slowly than the wool. The sulphuric acid, if not heated, has very little effect upon the wool, but destroys the silk, leaving a yellow color, and dissolves the cotton rapidly.

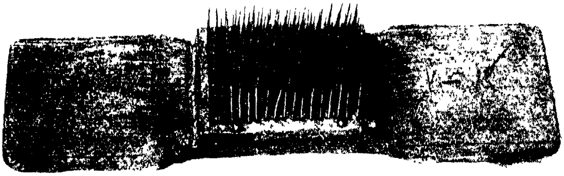


FIG 75. An Old Hackle Bearing the Date 1767

Make a chart of all the tests for all the fibers.

Finding how factories began. Consult industrial histories and encyclopedias and find the methods of production and condition of the workers in what is called the handicraft period. Find the changes that took place as the textile inventions were made. Note how the invention of the fly shuttle by Kay stimulated weaving so as to make the need felt for increasing the production of yarn. This need in turn led to the invention of a spinning jenny by Hargreaves, and this led to Cartwright's power loom to increase the amount of weaving. See page 434. This succession of inventions brought about the concentration of textile workers in the towns where the machinery was located. Gradually factories grew up. The women and children worked in them as well as the men. One of the first labor laws was a law prohibiting the work of children in factories for more than twelve hours a day, and providing that children who worked all week should go to school on Sunday to learn to read the Bible and repeat the catechism. Look in the encyclopedias and histories for the accounts of the industrial revolution, beginnings of factories, orphan schools, Lancastrian schools, the

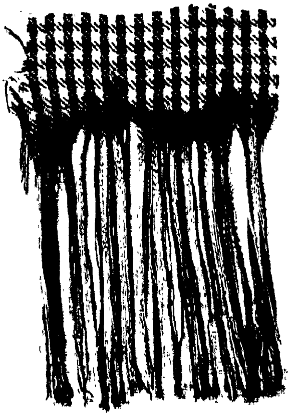


Fig. 70. Shepherd's Plaid after Treatment with Caustic Soda — Wool Destroyed, Cotton Remaining

work of Robert Owen, the beginning of the Sunday School under the leadership of Robert Raikes, and child labor laws.

Finding some of the conditions of piece workers. Notice that the factory established the piece-work method, whereas in the handicraft period each workman made all of an article. Read Robert Browning's poem, " Seven Men to Make a Pin." What are the advantages of the division of labor; the disadvantages? The teacher may well read the introduction to Helen Marot's *Creative Impulse in Industry.*

Find out what piece work is; sweat shops. Price some dresses or other garment in the store. Find the cost of the materials needed to make such garments. Find what a dressmaker would charge to make such garments. Compare the figures. Buy material and make a work apron. Keep an exact account of the cost in time and money. Go to a store and price aprons of the same pattern and quality. Who was paid the difference between the cost of materials and the selling price of the apron? How much did the person who made the apron receive? Read "The Song of the Shirt," by Thomas Hood.

Finding the prices of some of the standard textiles. Collect samples of the common textiles and find their prices. Grade the materials of a kind according to price and mount on a chart. Test samples of baby flannel to find which are all wool. How much does one have to pay for all-wool flannel? How much does one have to pay for unloaded taffeta silk? How much does one need to pay for a good pair of silk stockings? Does it pay to buy cheap silk?

Considering problems of headwear. A list may be made of the different kinds of headwear worn, and consideration may be given to which of these are most appropriate for each season and occasion. This will include various forms of hats, caps, hoods, bonnets, and other forms of apparel worn on the head. It will be of interest to collect pictures of the headwear of people in different lands. What are the chief materials out of which hats are made?

Differences should be found between the materials and qualities that distinguish expensive from inexpensive hats. What are the effects of different kinds of headwear upon health? What are the effects of different styles of hats upon the appearance of short, round faces, and of long, narrow faces? How do different forms of hair dressing affect the selection of the hat? To what extent must one think of the costume or costumes with which a hat is to be worn in selecting it? How should hats be cared for to keep them looking well? What are some of the inexpensive ways of changing the color or the trimming of hats?

Finding how to select clothing accessories. What are the problems connected with the selection and use of gloves? Ties? Collars? Handkerchiefs? Shawls or other shoulder wraps? Hair decorations? Necklaces, beads, pins, rings, and bracelets? Parasols and umbrellas? Furs? Consider each of these from the standpoint of selection and use as to taste, materials, cost, and care. Visit stores and shops to observe examples of each in considerable variety. What kinds of jewelry or other decorative accessories give one an appearance of cheapness or insincerity? One's personal appearance should be an harmonious composition. Any decorative feature that attracts attention more to itself than to the wearer fails of its proper purpose. Clothing and clothing accessories are expressive of character. We sometimes speak of dress as "quiet," or "loud." Is dress that is "loud" or immodest really beautiful? How may we select clothing and related forms of personal adornment to avoid the appearance of gaudiness or cheapness, and always to produce an impression of good taste, refinement, and genuineness?

Making budgets of clothing for sixth grade. Make lists of clothing needed for a sixth-grade boy and a sixth-grade girl for a year. Find market prices of each item and find the total cost for the year. Each child will be interested in comparing these figures with what mother actually spends, just for his own satisfaction. What hygienic questions are involved in budgets? How much attention should one give to seasonal clothing? How important is the fit of the shoe and the hose? How many woolen garments does one need to have? Are woolen hose essential in cold climates? What are the economic and hygienic effects of ill-fitting clothing? Compare the figures with the estimates in budget studies given in Woolman and McGowan's *Textiles* and in material on these same questions given by Ball and West in *Household Arithmetic*, pages 82–116.

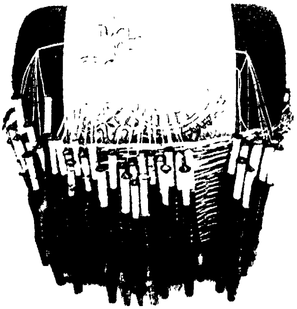
Listing some points in design to be considered in selecting a costume. In connection with the study of budgets, the children will note the difficulty in keeping budgets reasonably low and at the same time giving attention to good line, tone, and color in making a pleasing costume. This may raise questions as to what is good design. Using paper dolls or cut-out pictures from magazines, the children can easily illustrate the effect of stripes upon the appearance of height. Similarly they can find the effects of checks, plaids, or large-figured patterns. Note what trimmings do to a costume. Broad bands, belts, cuffs, and reveres tend to make one look broader. Narrow bands, running vertically, or nearly so, add to the appearance of height. Similarly, since harsh, stiff textiles suggest severity, or dignity, or solemnity, while soft, dainty ones suggest the gentle, the delicate, the little, those who are unusually large should avoid the dainty either in texture or design. Again, the textile of dull character absorbs the light while the lustrous reflects it. Note further the effect of lines placed in contradiction to the general contour of the figure. Lines in the design, whether seams, trimmings, or folds, should be placed so as to be in harmony with the structural divisions of the body. Note the changes in moving the waistline or the shoulder seam. Notice the limitations in the use of a textile having a pronounced design. Only a few can wear it. In making a dress of it there are only a limited number of ways in which it can be designed. Trimming possibilities are very few. Try ways of constructing a two-piece costume, using two different materials. When the waist and skirt meet in a straight-line fashion, see how impossible is the effect of unity. Try ways of connecting the two parts of the costume through trimmings and interlocking designs.

Color likewise needs careful selection, relative to the individual's natural coloring. Note the economy of selecting garments following a consistent color scheme. The effects of neutrals, the possibilities of complementary and of neighboring colors, the limitations of the one-color textile as contrasted with the variant-colored textile, and the laws of subordination in color schemes — all need attention and experimentation.

These matters of selection in clothing are quite as important for boys as for girls. The selection of suitings, of hats, of shirts, of ties, of socks, and of shoes should all be considered as parts of the study of clothing for boys. Contests for both boys and girls in judging costumes with reference to their harmony and their fitness to particular persons are an excellent method of testing growth in appreciation of design.

Learning how to use a sewing machine. In connection with finding the history of the invention of the sewing machine, each child should have the opportunity to use a machine enough to learn how to run it and keep it oiled and clean.

Learning how to repair garments. In Grade III, the children learned how to prevent knitted goods from "running." Other items in the care and repair of clothing should be taken up, developing simple principles for mending, patching, and darning. This work connects with economic considerations in buying, growing out of the budget study.



Courtesy Metropolitan Museum of Art

FIG. 77. Pillow Lace, a Type of Art Textile Work

Wise buying of stockings is a part of the problem of determining the amount to be spent for stockings. Shall they be cotton, wool, or silk? What are the relative costs of these? What are the relative wearing qualities? When should one wear silk stockings? What are the points to be noted in examining a pair of stockings before buying? What are the consequences of too small a pair?

In darning a stocking, a soft darning material should be used. If a place is worn thin or a hole is to be filled, weaving in new material is the best method. The warp threads should be put in lengthwise of the knitted fabric. The best wearing shape for the darn seems to be the diamond, as it seems most suited to supporting the weakened fabric.

Care should be taken to weave the woof thread in loosely enough. Some advise leaving a tiny loop at the edge of the darn each time in drawing the woof thread through.

The children may be interested in ways of darning, designed to make the hole less conspicuous. The use of tailor's gummed tissue on the wrong side of the cloth is one means of closing a tear. The use of ravelings of the same material is another method, being valuable because it provides an exact match in color and quality of material. Darning so as to replace the destroyed pattern is an interesting study. Some have found that tears in flannel and broadcloth are best repaired by the use of hair. The fineness of the hair makes it possible to embed it in the thickness of the cloth so that stitches can easily be hidden.

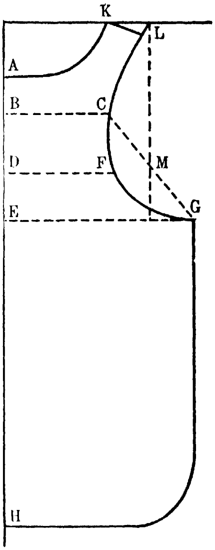


Fig. 78 Construction of an Apron Pattern

Making a work apron. Many pieces of work attempted in this grade are such as demand some protection for the clothing. A good work apron, such as suggested in Fig. 78, may profitably be made. In order that the children may get some insight into the problem of cutting a garment to dimensions, it may be well to take individual measurements and have each child cut a pattern under the common directions. The line *AH* indicates a fold of the goods down the front of the apron. *BC* equals one-half of the distance across the chest from armscye to armseye. *DF* should be about two inches longer than one-fourth the waist measure. *EG* should be one-third the hip measure. *KL* may be about three inches wide. To locate *L* connect *CG*. Find the middle of *CG*. *L* is in the line *LM*, which is parallel to *AD*. To avoid buttonholes, sew straps from *L* to *G* crossing the back diagonally.

Finding how to cleanse and preserve clothing. Some clothing materials may be laundered and some may be dry cleaned. Make a summary of kinds of materials which may be laundered, indicating the particular forms of laundering for each, and the kinds of soap or other cleansing agencies which may be used upon each to advantage. Dry cleaning may be done by first thoroughly brushing and airing a garment, then soaking it in gasoline for several hours or overnight, then wringing out, drying, airing, and pressing.

Garments should be kept well pressed, both when being worn and when stored. When put away for storage, all garments made of animal fibers — wool, silk, or fur — should be protected from moths. Find out the several ways for protecting clothes from moths. Garments which are worn should be brushed daily. All spots of grease, ink, paint, or other stains should be removed as soon as possible to avoid damage to the garment and because the longer the stain remains the more difficult it is to remove it. Consult a book on clothing to find out the best ways of removing stains and spots.

Desirable outcomes in Grade VI. From this work the teacher should expect:

1. Some understanding of the status of the United States in the manufacture of commercial dyes.
2. Some appreciation of the variety of colors obtainable from commercial dyes as compared with those obtainable from vegetable dyes.

3. Knowledge of how the flax fiber is produced.

4. Quite definite knowledge of the ways to distinguish the four textile fibers.

5. Some understanding of the significance of machinery.

6. Some knowledge of the industrial revolution and the beginnings of factories.

7. Some information about piece work, sweat shops, division of labor, and some of the conditions of factory work.

8. Knowledge of the prices one should pay for staple textile materials.

9. Knowledge of how much a sixth-grade boy's and a sixth-grade girl's clothing should cost.

10. Some acquaintance with the care and use of a sewing machine.

11. A growing interest in line and color relative to clothes.

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Includes budgets, fabrics, designs, colors, patterns, and processes of construction. Suitable for teacher's reference.

BALL, K. F., and WEST, M. E *Household Arithmetic*, pp. 89–116. Lippincott.

Chapter on clothing contains much valuable material relative to amounts, costs, and budgets — a high school text, excellent for reference for teachers and children of the upper elementary grades.

BROWN, EDITH A. — *Peeps at Industries — Rubber.* A. & C. Black, Ltd., London.

A very inclusive account, giving history, processes, kinds, historical developments, factory methods, and rubber products. Well illustrated

CHAMBERLAIN, J. F. — *How We Are Clothed.* Macmillan.

A geographic reader. Can be used by the children. Discusses production of many materials used for clothing.

COOLEY, A. M., and SPOHR, W. H. — *Household Arts for Home and School.* Vol. I. Macmillan.

Contains details pertaining to textile materials, sewing processes, and care of clothing, including darning, patching, and removing stains.

EARLE, ALICE MORSE. — *Home Life in Colonial Days.* Macmillan.

Rich in details descriptive of clothing and other processes.

GIBBS, CHARLOTTE. — *Household Textiles.* Whitcomb and Barrows.

Discusses early processes of Egyptians, Peruvians, Pacific Islands, and American Indians; colonial processes with wool and flax, and modern factory processes. A good reference for upper elementary grades.

GODDARD, P. E. — *Indians of the Southwest.* American Museum of Natural History, New York City, Handbook Series No. 2.

An attractive description of the blanket-and-pottery-making Indians. Illustrations excellent.

HALL, JENNIE. — *Weavers and Other Workers.* Rand, McNally.

Written in a style for third-grade reading. Attractively illustrated. Stories and descriptions of pastoral peoples of olden time and now.

HOOPER, LUTHER. — *Hand-loom Weaving.* Rand, McNally.

Very detailed directions for using a loom both for simple weaving and for pattern weaving, including brocades, tapestries, tissues, and velvets.

KINNE, H., and COOLEY, A. M. — *Clothing and Health.* Macmillan.

Contains detailed information relative to the selection of clothing, qualities of various materials, processes in sewing, and care of clothing. Suitable for the use of the children in the upper elementary grades.

KISSELL, MARY LOIS. — *Yarn and Cloth Making.* Macmillan.

Very detailed in history and technique of spinning and weaving.

WATSON, KATE HEINTZ. — *Textiles and Clothing.* American School of Home Economics, Chicago.

Includes primitive methods, weaving, fiber studies, modern methods, studies of fabrics, mending, darning, and sewing. Valuable for its illustrations.

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Chapter 7. An interesting account of processes in the textile mills.

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Well-illustrated, authentic descriptions. Excellent reference for children.

WOOLMAN, MARY SCHENCK. — *Clothing — Choice, Care, Cost.* Lippincott.

Discusses limitations, suitability, and value of cotton, woolen, worsted, silk, and linen fabrics with reference to budget studies. It is helpful in its discussion of care, repair, renovation, dyeing, and cleaning of clothing.

WOOLMAN, M. S., and MCGOWAN, E. B. — *Textiles.* Macmillan.

A very inclusive source of information for the teacher relative to textile materials, spinning, weaving, microscopic studies, dyeing, laundering, and budgets.

WORST, EDWARD F. — *Foot-power Loom Weaving.* Bruce Publishing Co., Milwaukee, Wis.

Very careful directions for spinning, preparing the warp, threading the loom, and weaving. Contains much information about old-fashioned coverlets and the drafts for weaving them.

CHAPTER IX

SUGGESTIONS FOR THE STUDY OF SHELTER

GRADE I

Finding what other homes are like. The discussion of the family life includes attention to the house and its furnishings. These constitute the one place which the child knows best. The discussion of the things in the home, where they come from, and what use is made of them is a means of leading the child out into a larger experience and of arousing interests which may be far-reaching in his growth. Through this he may find that all homes are not just alike and that all mothers do not manage the house in just the same way, but that there are some elements common to all homes.

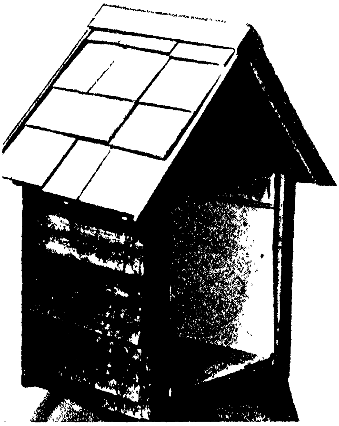


FIG. 79 A House Made by a First-Grade Child

The location of the house relative to the view, sunlight, air, available water, and drainage; the structure of the house, its size, shape, the materials of which it is made, and the number and purposes of the rooms; the way the house is heated, lighted, and ventilated;

the furniture in the house, where it was bought, the materials of which it is made, how it is cared for, and of what use each piece is; and who keeps the house clean, airs it, buys new furniture, and pays for it, are some of the topics to be considered.

Making a doll house. To make this discussion real it should be associated with the construction and care of a doll house, together with the exchange of ideas as to how mother or father does the various tasks in the home. Many kinds of doll houses have been made. The type to be used as a basis of this work depends upon local conditions which must be judged by the teacher who undertakes the work. Some teachers have made a frame house. They have used joists, studding, weatherboarding, rafters, and shingles, cut to proportionate sizes. The children had merely the problem of sawing to length in framing the house and assembling its parts. In some cases the children as a group have made one house; in some others each child has made one house.

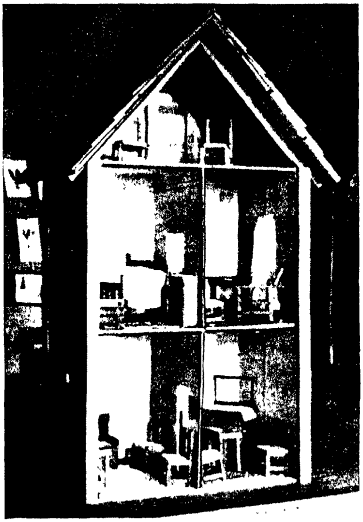


FIG. 80 A House Made and Furnished by a First Grade

In either case the work will take a long time, but it yields valuable results in the kinds of interests it develops. Another method is to use a box, cutting holes with a key-hole saw for doors and windows. If wooden boxes small enough and of uniform type can be secured, a good group house

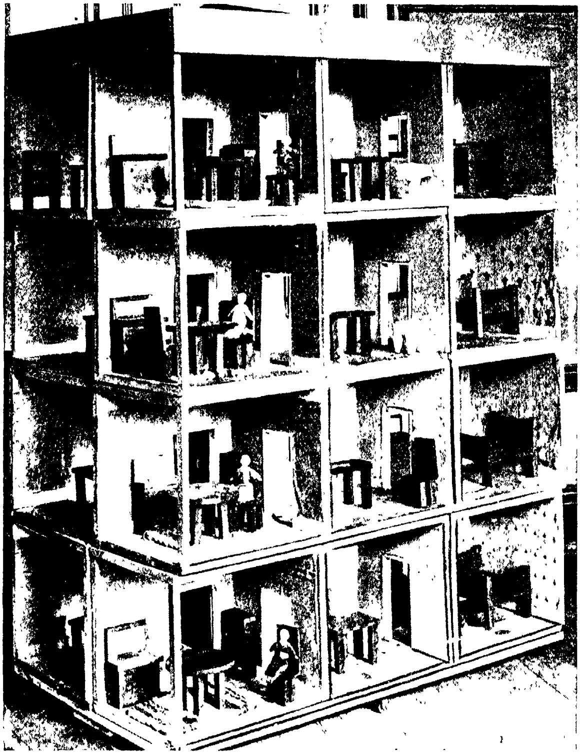


FIG. 81 An Apartment House Made by a First Grade

can be built by letting each room be made by a group of children and then assembling the rooms into a whole house. Some teachers have found cardboard boxes used in this way quite satisfactory. In any case a house in process of construction should be visited if possible.

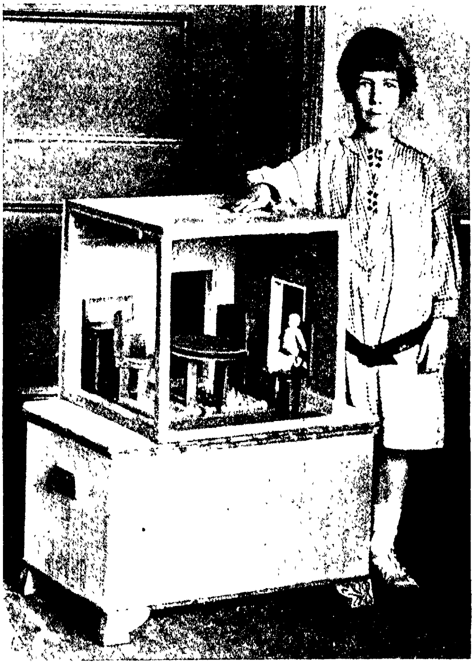


FIG. 82. A Room of the Apartment House and the Child Who Made and Furnished It

In planning the rooms, each room should, in turn, be the subject of class discussion as to its function and best arrangement. The reason for having the bathroom white and tiled, the custom of having the kitchen very white or light, why the bedrooms should be so arranged as to have plenty of sunshine and air, the arrangement of the living room so as to make it suitable as the center of the family life, the number of windows needed in each room, and the means of making the dining room an attractive, cheerful place are some of the points to be considered.

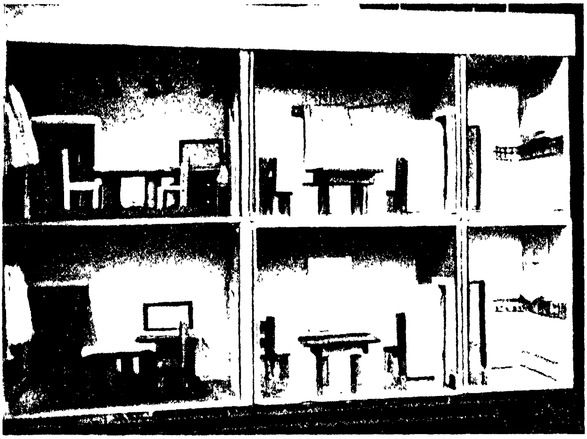


FIG. 83. An Apartment House Built by Another First Grade

Making a brick chimney. Just as no picture of a house drawn by a child is complete without a chimney with smoke coming out, so a house he is building will probably be more satisfying if it has a chimney. To shape the bricks, make a mold by nailing some narrow strips along a board which is as wide as the bricks should be long—perhaps one and a half or two inches. Set in partition boards far enough apart to leave space for the width of the bricks. This width should be half the length. The children should find out these proportions by measuring some bricks. The bricks are made by pressing clay into the spaces of the mold. When partly dry, remove and place where they can dry thoroughly. Bake in a kiln, if available. If not, put in the hottest place in the furnace to bake.

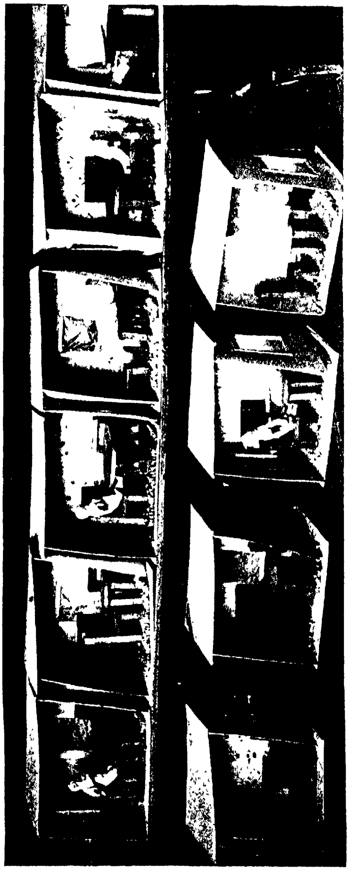


FIG. 84. A Collapsible Type of House for the Study of Shelter

When the building of the chimney is under discussion, have the children tell how the bricks are placed one upon another. Let them try to draw a portion of a brick wall. Then let them examine a wall or chimney to see what the usual arrangement is. They may note several forms of arrangement, however.

Have them find out how the bricks are held in place. Mortar of lime and sand was once used exclusively, but to-day a cement mixture is often used. This is much harder and will give better results. Get some commercial cement and some sharp sand. Mix dry thoroughly in the proportion of three parts of sand to one of cement. Mix with water, preparing only a little at a time lest it set before using.

This work with the brick chimney should include some explanation with pictures of the brick factory and its kilns or a trip to such a factory.

Painting the house. Some paint, old clothes, brushes, and paper to protect the floors are needed. If possible, go to see a man painting.

Making the wall paper and putting it on. After the windows and doors have been cut and the strips of lumber nailed on for casings, the question of making the walls attractive should be taken up. Discussion of how walls are finished will bring out the fact that most walls are first plastered on the inside. To make the idea of plastering clearer, the children should visit a house that is being plastered. Call their attention to the way the laths have been placed on so as to hold the mortar. If a house in just this stage is not available, there may be an old house where the plaster is falling off. This will enable the children to understand. If this also is lacking, some lath could be nailed on two studding fastened in a parallel position and some mortar be mixed and the attempt be made to put it on. From any of these experiences it will be evident that to plaster the doll house is impracticable.

It will easily be decided that the best thing to do is to paper the house. To help in the idea a sample book may be borrowed from the wall paper store. This will show the children how varied wall paper is. They may also bring in illustrations cut from household magazines. Simplicity of design will be noted. Small houses should have plain paper with a border at the top. Stripes can well be used in bedrooms in small houses. From the discussion, ideas should crystallize into definite plans for papering the rooms of the doll house. Crayolas can be used in making the designs.

Making the furniture. Many ways of making furniture have been tried. Some have used the "sixteen-fold" method, using paper for the material. Some have worked out elaborate directions for cardboard furniture. Some have used wood, following the construction actually found in the furniture industry. All these seem too tedious for little fingers, tending to violate the muscular and nervous development of the child. In deciding what type of furniture to make it is well to recall the principle that in any handwork in these industrial studies, it is adequate for Grade I that the thing made satisfy in form and function. In applying this we find that block construction is sufficient. A chair is made by nailing a flat board on a cube so that the board extends above far enough to serve as a back. A

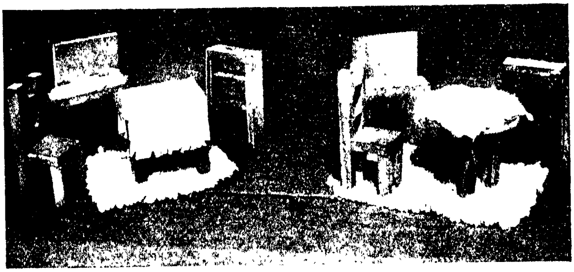


FIG. 85. Some Furniture Made by First-Grade Children

bed takes an oblong block and has a board nailed on each end so that the boards extend above, one for head board and the other for foot board. Other pieces of furniture may follow similar construction.

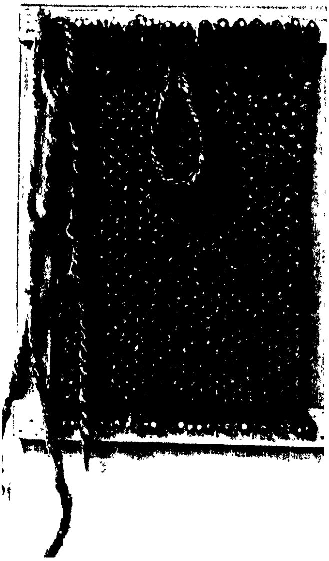


FIG. 86 A First Grade Loom and Rug in Process of Weaving

Making the rugs. A loom can be made of four sticks. Lay the two long ones parallel. Nail the two short ones on these at the ends. Along each short stick drive a straight row of tacks about one-fourth inch apart. String the loom with cotton twine, passing it around the tacks from end to end. Use, for woof, cotton roving or rags torn about one inch wide and sewed together. For decoration, a different color may be woven in near each end. If the children have trouble keeping the edges straight, stiff wires can be fastened in screw eyes along the edges and the children can weave over these. The wires can be slipped out when the weaving is finished. When the rug is woven, a fringe can be made. Cut the material to be used into lengths a little more than twice as long as the fringe is to be. Fold these threads in the middle. Use a crochet hook to pull this

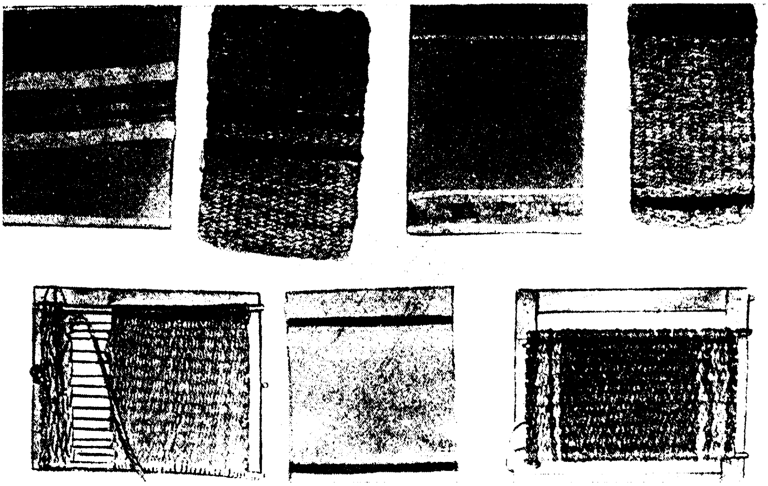


Fig. 87. First Grade Designs, Looms, and Rugs

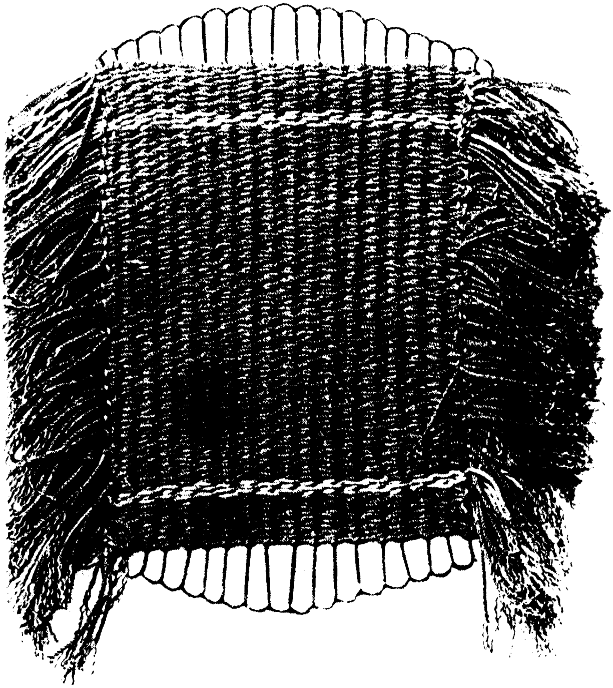


Fig. 88. A Cardboard Loom and a Hammock Woven upon It

loop through the end of the rug. When it has been drawn through about an inch, push the ends through the protruding loop and draw them tight. Do this until you have fringe all the way across both ends.

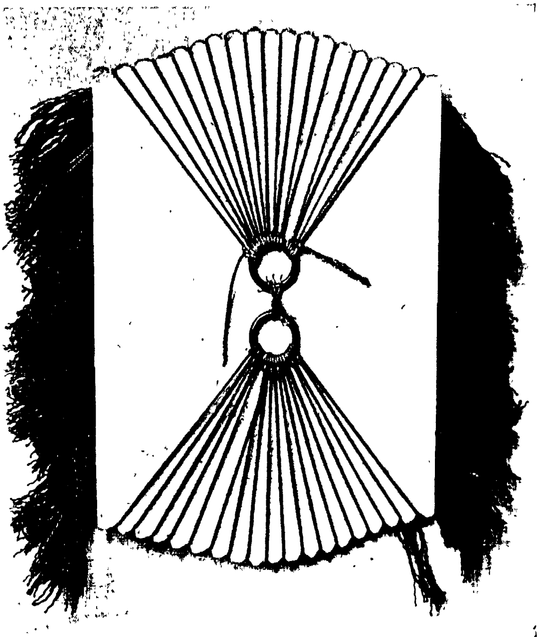


FIG. 89. Showing the Method of Attaching the Thread to the Rings of the Hammock

Desirable outcomes in Grade I. From this work the teacher may expect:

1. A more generalized concept of what the home is.
2. A beginning of an understanding of cleanliness in the home.

3. Some understanding of house planning and construction.
4. An understanding of the simplest facts about brick-making and brick building.
5. Some idea of simplicity in wall paper as an essential of beauty in a small room.
6. Some notion of appropriateness of furniture to use.
7. Some idea of simple rug weaving.

GRADE II

Using a screen instead of a doll house. Making another doll house does not seem advisable. The children are a year older and they have utilized the doll house nearly to the full. Yet there are situations calling for some method of visualizing and realizing the situation under discussion. A folding screen of four or five sections, having a window in

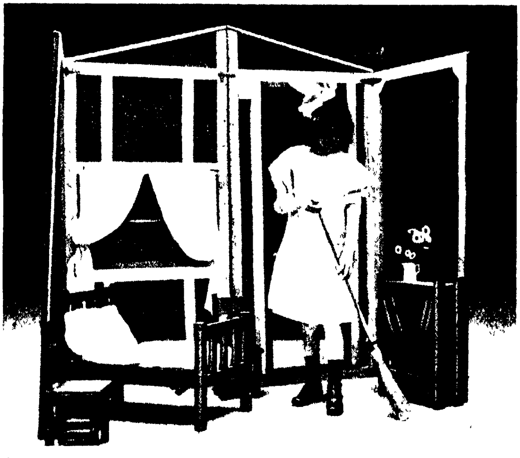


FIG. 90. The Screen Used as a Bedroom, Furnished with Pieces Made by Second-Grade Children

one section and a hinged door in another, seems to meet the needs without wasting time in rebuilding.

Making usable furniture. To carry out the use of this screen some furniture of usable size is desirable. Some teachers have used a screw construction type, made quite like our simple straight-line chairs. Such work requires a metal miter box and saw to eliminate difficulty in sawing sticks off exactly square. It also requires a vise and brace and bit to make the holes for the screws. For a discussion of such work see Manual Training and Vocational Education, March, 1915, pages 416-425, for an article by Iza E. Andrix entitled "An experiment in the Making and Use of Furniture by Second Grade Pupils." Figure 94 shows a type of furniture better suited to the possibilities of schools where furniture of the screw type of construction is not practicable. Orange and apple boxes were used, parts being cut away to shape the desired pieces.

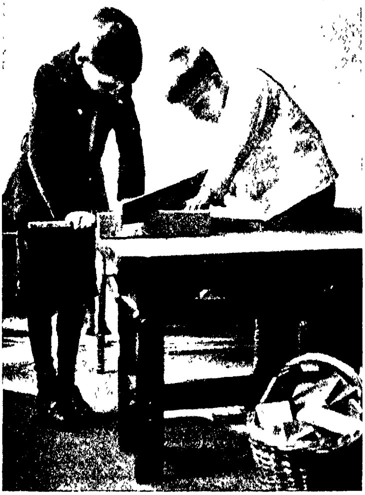


FIG. 91. Using a Miter-box in Making Furniture

Using the furniture and screen. Dramatizations often call for such equipment. It can be used at lunch time by

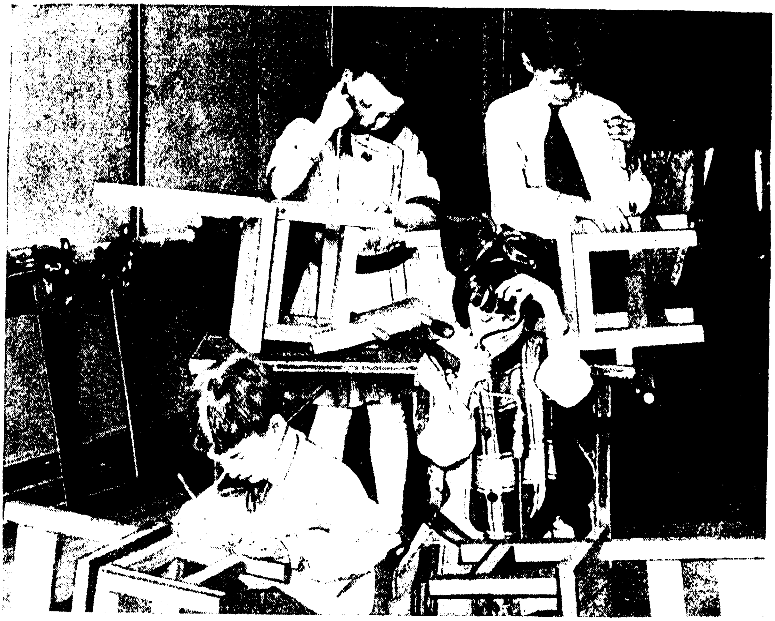


FIG. 92. Making the Furniture

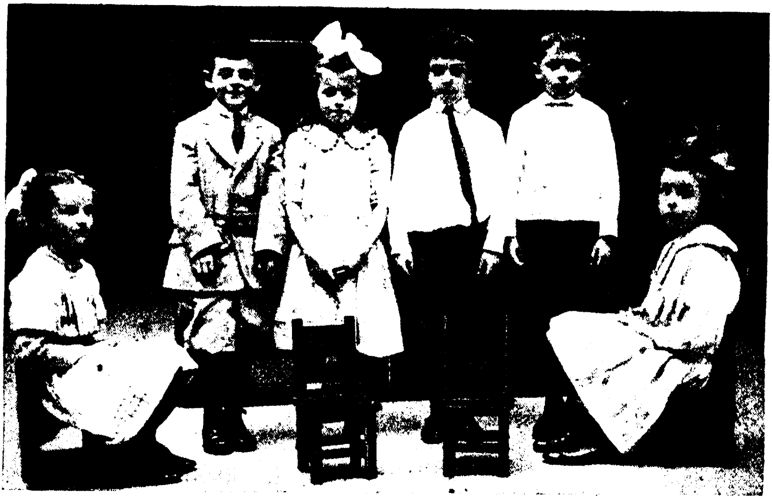


FIG. 93. The Children Who Made These Chairs

the family appointed each week to care for the house. This furnishes splendid opportunity for enforcing the need for simple, correct table service and manners. An illustration of this is shown on page 285.

Making curtains. Curtains can be made for the window, designing with simple stick printing by way of stressing another element in making the home attractive. Keeping these clean emphasizes the importance of cleanliness of hangings in the home.

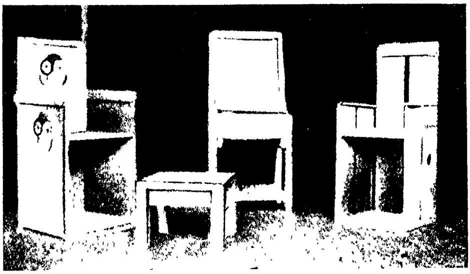


FIG. 94 Some Furniture Made of Orange Boxes

Visiting the lumber yard. When making estimates for the furniture, the consideration of kinds of lumber needed should lead to the lumber yard as the source of lumber. The children may there see lumber as it is stored for sale. Different sizes of lumber, different kinds of wood, and other building materials, including shingles, nails, laths, sand, lime, and cement can be pointed out. Some one should raise the question as to where the lumberman gets his different kinds of lumber.

Gathering pictures and information about lumbering. Government publications are very helpful and stimulating sources of information, although the reading material may be beyond second-grade ability. Magazine articles and textbooks in geography often contain excellent pictures. A miniature lumber camp can be made in the sand-table from the ideas gained through the pictures. A small tree

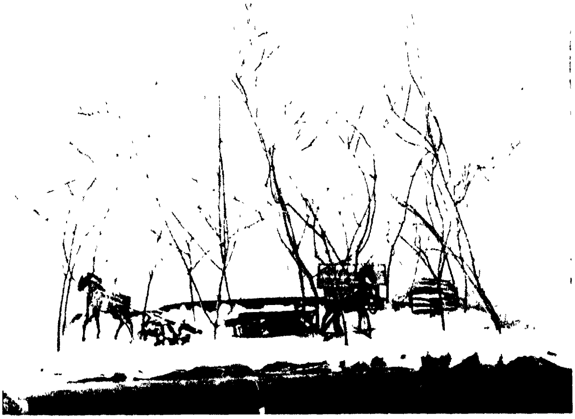


FIG. 95 Model of a Lumber Camp Made by Children

may be cut down and taken to a man who has a band saw, in order that the children may see it cut into lumber. Call attention to the slabs.

Comparing our homes with the dwelling places of primitive man. The value of our conveniences will be much more appreciated if the ways primitive men lived are compared with our ways. The stories by Miss Katherine Dopp, referred to on page 92, furnish excellent material. Note the living in trees, the value of the discovery of fire, enabling them to keep wild animals out while they inhabited caves, the work of Firekeeper in protecting them at night, the lack of furnishings to make the cave comfortable, the use of skins for warmth, the beginnings of weaving in twining sticks in and out among saplings bent together to make a hut, the weaving of mats, the selection of a cave near a stream to provide water, the location of the home near roots and berries, and the crude drawing on the walls of some caves as evidence of interest either in art or in making a record.

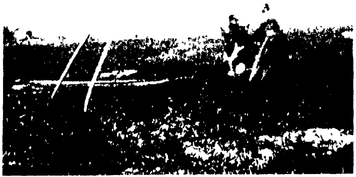
Comparing our modern coöperative conveniences with clan life. The work of a firekeeper may be compared and contrasted with that of our fire department; and the location of the home near a stream with our city problems of providing pure water. Such an achievement as the Ashokan Reservoir for New York City can be used to illustrate how important it is that a large community coöperate. The National Geographic Magazine for July, 1918, in an article by W. J. Showalter gives excellent illustrations for this study. The article is entitled " New York — Metropolis of Mankind." Using these pictures, one can make comparison with the water system of the local community. Local methods of lighting and heating the house may be compared with those used in other communities. The work of primitive men in hunting and fighting may be compared with the work of the police and the army. The way in which boys and girls were taught in primitive communities should be compared with our school systems and libraries.

Desirable outcomes in Grade II. From this work the teacher may expect:

1. A clearer notion of the meaning of coöperation.
2. A greater appreciation of home and conveniences.
3. A somewhat better notion of furniture construction.
4. A beginning of understanding of lumbering processes.
5. Some notion of what a lumber yard contains.
6. Some conception of primitive conditions of living.

GRADE III

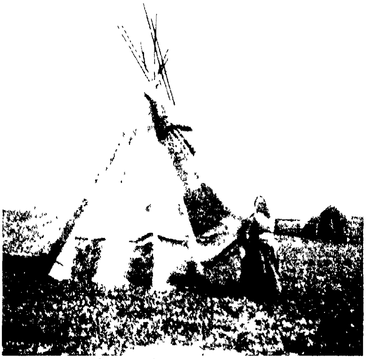
Making a collection of pictures of famous houses. Post-card pictures are common in the children's experience. Friends, traveling, send them home. An interest in collecting pictures of famous houses may be made quite worth while, as it will enlarge the reach of the children's interests and will tend to broaden the conception of how varied houses may be and yet meet the needs of a home. Such places as these may be suggestive: Mt. Vernon; Longfellow's birthplace; Irvington, the home of Washington Irving; Lincoln's birthplace; Roosevelt's birthplace; the Van Cortlandt mansion; the Alamo; Monticello, the home of Jefferson; the home of Edgar Allan Poe in New York City; Windsor Castle; Shakespeare's home at Stratford-on-Avon; Longfellow's home at Cambridge; as well as places of particular local interest. Find why these are of interest and note the varied structure.



Courtesy American Museum of Natural History

FIG. 96 A Blackfoot Indian of Montana Setting Up the Lodge Poles

Making an Indian wigwam. In connection with the study of Indian life in this grade the children should get a clearer notion of the type of house the Indian lived in. The ease with which it could be carried from place to place, the importance of selecting just



Courtesy American Museum of Natural History

FIG. 97 Placing the Cover on the Tipi

the right kind and number of lodge poles, the use of skin for covering, the shape of the skin, the opening at the top for letting out smoke, the way this was shaped and attached to a pole for closing as the direction of the wind necessitated, the custom of building the fire on the floor in the center, and the use of buffalo skins for beds and seats are topics which should receive attention. Read the selection from Parkman's *The Oregon Trail,* Chapter XIV, describing the Indians' moving from place to place and packing the wigwam on the lodge poles to be dragged by ponies.

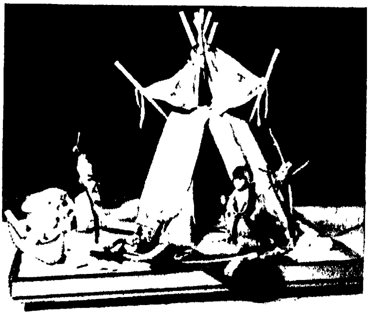
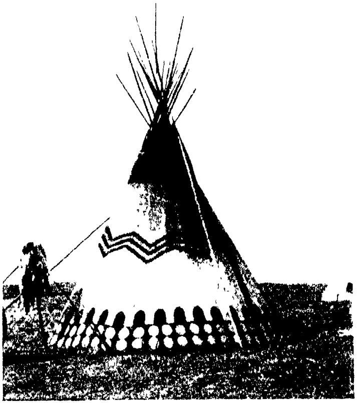


FIG. 98 Model of an Indian Tipi

Finding how the Pueblo Indians built their homes and why. The National Geographic Magazine for June, 1921, page 652, and March, 1922, pages 322–331, contains accounts by R. H. Moulton and N. M. Judd, respectively, of investigations being made under the direction of the Smithsonian Institution of some of the ruins of Indian pueblos, especially the Pueblo Benito. Gather other pictures and information about these pueblos. An entire community lived in one pueblo. The entrance was not by a front door but by ladders up to the roof. Can you think why? The pueblos were usually built upon high, inaccessible places to make them easily defensible. Such gardening as was done was conducted in the valley near by. The grain and the vegetables were stored in interior rooms. Water had to be



Courtesy American Museum of Natural History

FIG. 99. A Blackfoot Tipi

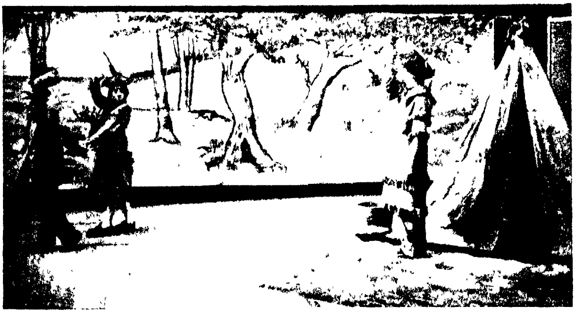
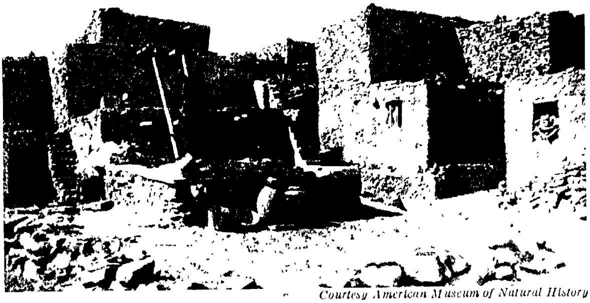


FIG. 100. Dramatizing an Indian Story

carried up the steep trail and then up the ladder from the stream below. Do you see many windows in the pictures?



Courtesy American Museum of Natural History

FIG. 101. An Indian Pueblo in Arizona

Many chimneys? Why did these Indians build such different houses from the houses of the Indians of the plains? What was the difference in their occupations?

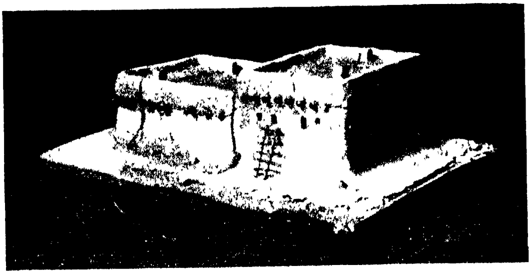
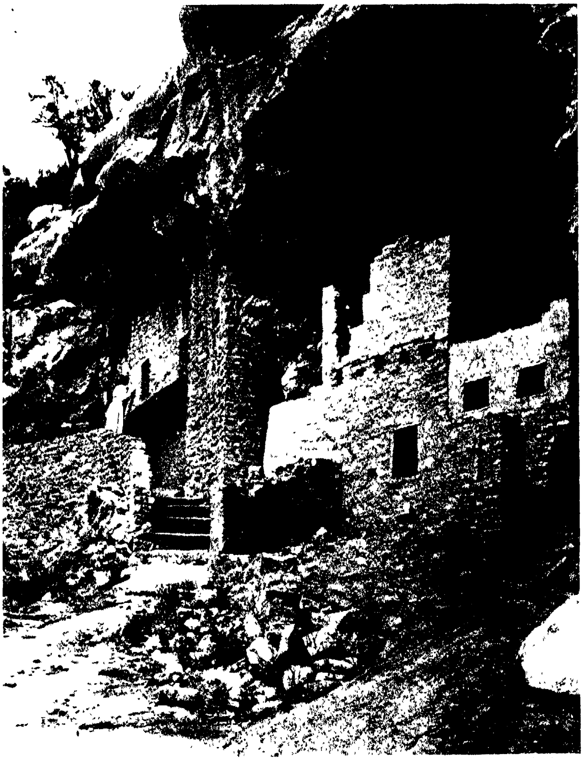


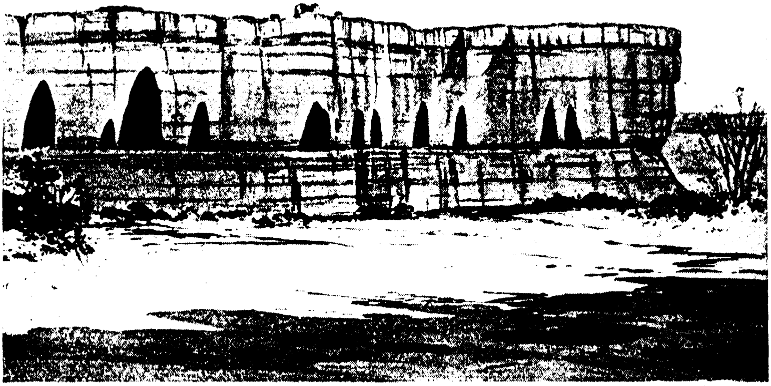
FIG 102. A School Model of an Indian Pueblo

Finding what the cliff dwellers' houses were like. Read Clara Kern Bayliss' book, *Lolami, the Little Cliff Dweller*, and see if you can compare a cliff dwelling with a pueblo. Some one has said that the people in New York City who live in apartment houses of from six to twelve or fifteen stories in height are the New York cliff dwellers. Why?



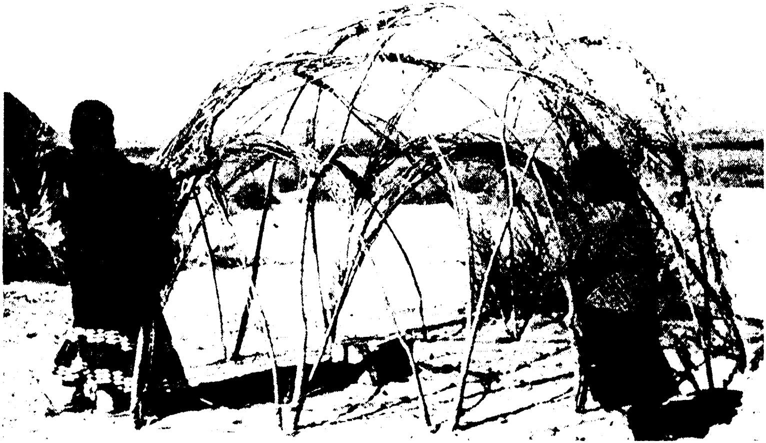
Courtesy American Museum of Natural History

FIG. 103 A Cliff Dwelling in Colorado



Courtesy American Museum of Natural History

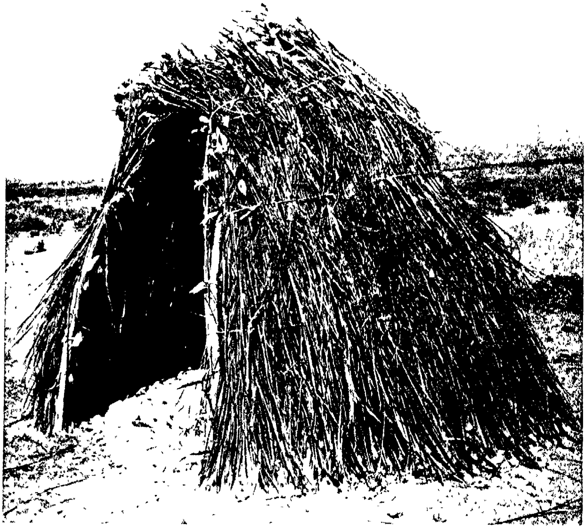
FIG. 104. Cliff Ruins on San Juan River in Arizona



Courtesy American Museum of Natural History

FIG. 105. Apache Building a House

Which of these houses is more convenient? More sanitary? Which do you think will stand the longer? Some one has said the rows of apartment houses along upper Riverside Drive in New York City constitute man's Palisades of the Hudson to parallel nature's Palisades on the other side of the river.

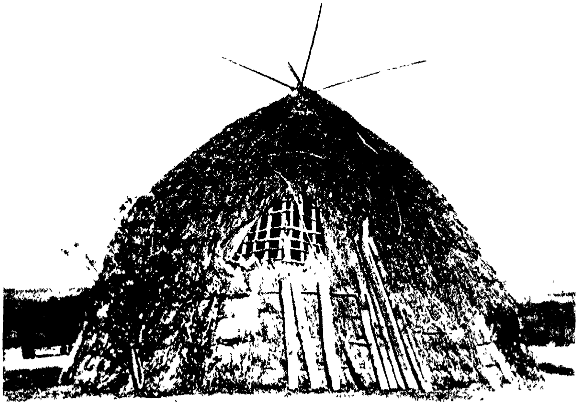


Courtesy American Museum of Natural History

FIG. 106. Indian House at Calva, Arizona

Sometimes the Indians of the southwest wove houses of saplings as shown in the pictures, Figs. 105, 106, and 107.

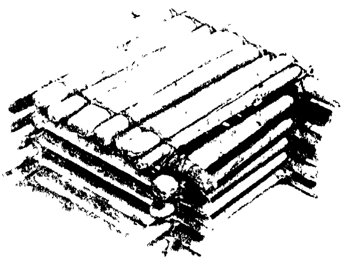
Finding how the Indian woman furnished her house. As mentioned before, the Indian woman of the plains used a buffalo robe for a seat or a bed. The Indian of the Southwest wove a blanket. See the chapter on Clothing, Grade III. Her dishes and baskets, which are mentioned in the chapter on Utensils, were not numerous but harmonized in design and color with her blankets. Her mortar and pestle, mentioned in the chapter on Foods, completed her household furnishings.



Courtesy American Museum of Natural History

FIG. 107. Wichita Indian House, Oklahoma

Comparing the Hebrew tent with an Indian wigwam and with our houses. Like the Indians of the plains, the early Hebrews were a migratory people — roaming, not to hunt game, however, but to find pasture for their flocks and herds. The tent cover was rough, made of strong, coarse cloth woven from dark goat's hair. The earliest Hebrews used the skins of goats for covers. The cover was commonly supported by nine poles arranged in rows of three. The middle row, parallel with the front row, was from six to seven feet higher than the other rows. The roof thus sloped to the front and the back. The cover was held in place by pins driven into the ground. A curtain of the same sort of material was hung around the exposed side of the tent to break the force of the sun's rays and the cold winds. A similar curtain through the middle of the tent divided the space into two compartments, one for men and one for women. Often the tent was striped because the cloth was woven in long narrow strips and these were sewed together. The cloth shrank with use until it became quite waterproof.



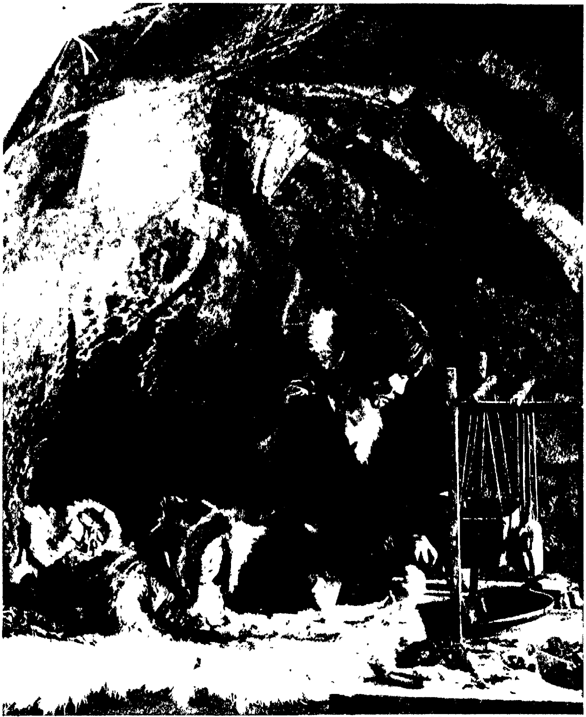
Courtesy American Museum of Natural History

FIG. 108 A Pima Indian Chair, Arizona

"The black tents of the nomads have flitted, shadow-like, over Syrian fields and Arabian steppes from the dawn of human history."

How does this type of tent differ from an Indian wigwam? Which would be more comfortable? Which would be more easily moved? What advantage have such shelters as those of the Indians and Hebrews over ours? Do you see any disadvantages?

Making a model of an Eskimo snowhouse. The Eskimos are a roving people, living in summer near streams in open houses made of bark or boards. In the winter some of them build houses of snow convenient to fishing in the ice. The main part of the house is rounded over the top. Connecting with this are rooms in a series constituting a passageway to the outside. The outermost passageway curves around in a half circle to shut out the cold wind. There is no ventilation other than what can come through the snow. The fireplace is a vessel with two uprights across which is laid a bar. On this bar is hung a piece of fat which drips



Courtesy American Museum of Natural History

FIG. 109. Eskimo Woman Cooking in Her Snowhouse.
The walls of snow are lined with skin.

oil into the pan due to the heat from the burning oil in the pan. For a chair the woman sits on a bundle of sealskins.

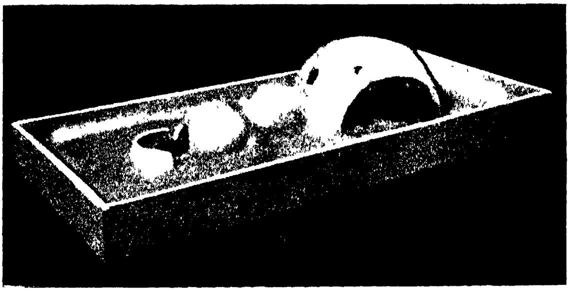


FIG. 110. Salt-and-Flour Model of an Eskimo House

A model can be made of clay or by using a flour and salt mixture. Or, the children in cold countries can try modeling one in snow.

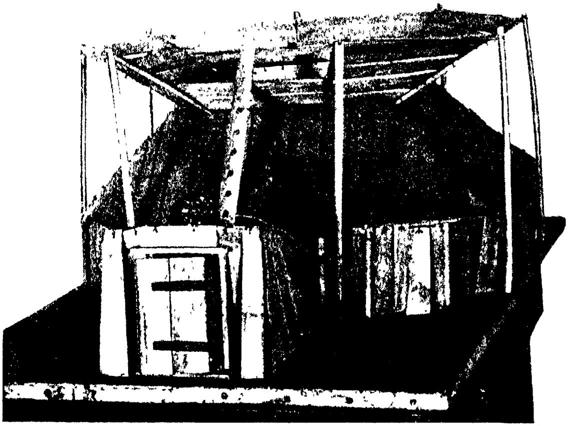
Desirable outcomes in Grade III. From this work the teacher may expect:

1. A more extended notion of variety in houses.
2. A beginning of the notion that houses are an adaptation in part to the country and in part to the habits and occupations of the people; and that the materials available in any place and the climatic conditions are very exacting factors.
3. The knowledge that there were several different kinds of Indians with very different homes and occupations.

GRADE IV

The work in geography in this grade is usually intended to give the child a notion of the world as a whole. In gaining this notion, products familiar to the child may be traced to their source, the method of production found out, and the lives of the people who do this work may be noted. This will bring to the children's attention many different kinds of homes.

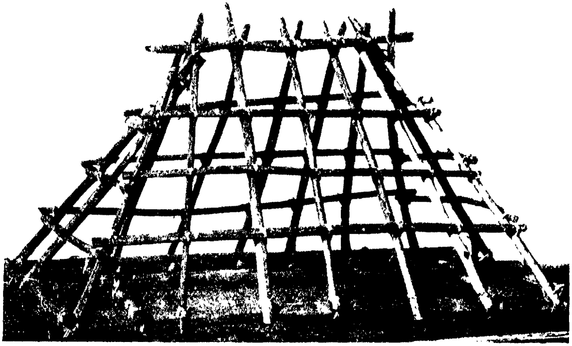
Making a collection of pictures of various kinds of houses. It will be interesting and profitable for the children to gather pictures of as many different kinds of houses as possible and classify them according to the material used in their construction. If arranged into a chart, the climatic conditions to which they are adapted may be noted. Note the variations in a stone castle, a Mexican adobe, an Italian villa, an Eskimo snowhouse, a Japanese pergola, a Philippine bamboo house, a Kansas prairie sod house, a miner's cabin, a New York City apartment house, a California bungalow, a colonial house, a Mississippi house boat, a log cabin, and



Courtesy American Museum of Natural History

FIG. 111. A Siberian House

a New England farmhouse. Note how many characteristic American types there are. The National Geographic Magazine for April, 1919, contains excellent illustrations of the cone dwellings of Asia Minor, a very unusual type of house to contrast with others which the children may study.



Courtesy American Museum of Natural History

FIG. 112. Frame of a House in East Siberia

Making a log cabin. Those children who have not a log house near, which they can visit, may be interested in making a model to see how it was constructed. The logs should be notched to fit at the corners, the cracks can be filled with clay, the door fitted with a latch and latch string, the windows covered with oiled paper, the roof clapboarded, and the floor made of puncheon. The chimney should be built of pieces of stone. Since clay and mortar will not hold the chimney together well because the pieces of stone used will not weigh enough, a cement and sand mixture, in the proportion of three parts of sand to one of cement, would better be substituted to insure success.

Finding how a colonial house was furnished. Gather such pictures and descriptions of colonial furniture as can be found. The broad fireplace with the high-backed settle on either side and the splint-bottomed chairs constituted the center of interest. Benches were sometimes made by putting legs in a half-log. In some of the better homes in later colonial times spinets, tall clocks, four-poster, canopied beds bureaus, chests of drawers, highboys, writing desks, — all handmade, often of imported mahogany or of native black walnut—were to be found.

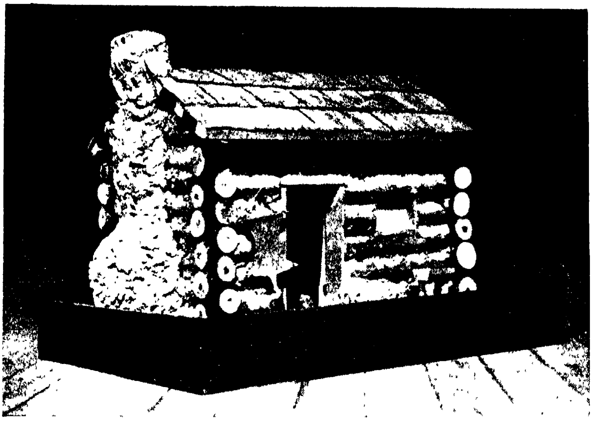


FIG. 113. Model of a Log Cabin

Making candles. The houses were lighted with candles, although many evening tasks were done by firelight. If possible, borrow a candle mold and make some candles in it. Make some dipped candles by tying several pieces of coarse cotton twine, for wicks, along a stick. Dip the strings into some hot tallow. Allow the strings to cool.

Dip and cool, and continue until the candles are as large around as is desired. If the climate is very warm, it may be necessary to substitute paraffin for tallow, since it hardens more easily.

If bayberries grow in the vicinty of the school, gather some. Throw them into boiling water. The wax will be released and float to the surface. Skim it off. Melt again and allow impurities to settle to the bottom. Use this in making candles as the tallow was used. It may be used pure but it often is mixed with tallow. The bayberry candles are appropriate for Christmas time. In this connection collect stories of Christmas customs with the use of candles.

Collecting pictures, samples, and information about lighting houses. This making of candles will be likely to raise questions as to when electric lights were invented. Some of the children will have seen kerosene lamps. It will be well to utilize these questions in stimulating an interest in finding out the various ways in which houses have been lighted. People in the community may have some interesting lamps, candlesticks, and other lighting devices which they will lend. The pitcher lamp with a wick may be made of clay. See page 303.

Making candlesticks. Candlesticks of metal, glass, or clay are preferable to wooden ones since the danger of fire is thus avoided. To make one of clay follow the general directions for making a vase. Make the base as directed. Apply one or two coils along the outer edge to give the rim. Apply a coil around the center, making the inside of the coil just large enough to hold a candle of ordinary size. Make this coil about one inch high, or a little more. For a handle make a coil of rather firm clay. Soften one end and attach to a softened place on the center coil, and in the same way attach the other end to the rim.

Making a rag rug. See the chapter on Clothing, page 179, for the process of weaving a rag rug such as was used on colonial floors. Borrow some examples of braided rag rugs and of hooked rugs.

Finding various ways of heating a house. In connection with the colonial house and its fireplace, questions may arise as to how warm a fireplace kept the house. Some children may have been to summer camps or some may have heard people tell of almost burning the side turned toward the fire while the other side was chilly. What connection did the high-backed settle have with this fact? Find the various heating systems in use in the community. Collect advertisements of heating plants. Find the history of stoves. What did people do before coal was used? Find in descriptions of other lands how the houses are heated. What is a charcoal brazier? What is a foot-stove?

Comparing the Greek and Roman houses with ours. Bulwer-Lytton's *Last Days of Pompeii* suggests to the reader a type of family life very different from ours. The stories of Greek home life indicate a type of house somewhat like the Roman but much less elaborate. The following facts may aid in seeing how the Greek and Roman houses were adapted to a domestic life very different from ours:

The Greek house. In the city, the houses were crowded closely together. They were very small, some of the rooms being more like cells. Because the ordinary Greek spent his day away from home he had no interest in following in his home the grandeur of the temples. The foundations were of rough stone with mud and smaller stones filling in the spaces. Above this was the house of wooden frame. The walls were often of sun-dried, mud bricks. They usually were covered with a plaster. This poor structure meant that the houses of ancient Greece long ago fell into decay and disappeared so that we know little about them. Information must be secured by piecing together hints and references of ancient writers. From such data some idea has been formulated.

There was no opening on the first floor except the entrance. There may have been windows on the second floor. The clay-tiled roofs were used as a pleasure resort on warm evenings. The entrance led to a large inner court without a roof. It was the center of the family life. Here might be found a shrine or an altar to Zeus. A small room opened off either side the little hall leading from the outer door to the court. One of these rooms may have been for the slave porter, the other for horses or other animals. Sometimes these little rooms were workshops or offices. In this case they were connected with the street, not with the rest of the house. Chickens and birds might be found in the court. The court may have been surrounded by a portico or colonnade. A living room or hall was on one side of the court back of the portico. Other rooms — sleeping rooms, guest chambers, store rooms — all very small, were to be found around this court. Curtains or doors closed them off from it. To the rear of the court on one side was a hall of men, for banquets and meetings of men friends of the master. Strangers could go no farther than this hall. There were special quarters for the women and girls, either to the rear of the court on the side opposite to the hall of men, or upstairs. This suite had no connection with the hall of men. The poor probably cooked in the court, but the better class seem to have had a separate kitchen. No evidence of a fireplace has been found in any ruins, and it is thought portable ovens may have been used. Earlier the people seem to have used an open fire. An earthenware oven has been found in later houses. Some houses had cellars for storing wine. Charcoal in basins seems to have been used for heating. A bonfire might be built in the open court. Rooms were lighted by the court. Oil lamps of ancient types were used at night.

In the later centuries some attempts at interior decoration were made. Inner walls of marble coating or walls whitewashed or covered with stucco have been found in these later houses. Alcibiades seems to have decorated his walls with paintings.[1]

The Roman house. The primitive Roman house was a single room, in which the family lived, cooked the meals, did all their work, and offered sacrifices. There was no chimney, the smoke escaping through a hole in the top, through which the rain entered. Later a basin was dug in the floor to hold the water that came in, to be used for domestic purposes. No windows were made, light coming through the door. This one room was called the *atrium.*

Later a "lean-to" was built back of this. Next the atrium was widened, pillars marking the old limits. The spaces beyond the pillars formed recesses called *alæ.* These contained the images of the ancestors. The "lean-to" developed into the *tablinum*, a recess to the atrium. Back of this was the *peristylium*, a court, open to the sky, with a colonnade around it. The atrium was for a reception room, the peristylium for the family and intimate friends. The latter was surrounded with rooms and set with flowers, trees, shrubs, and a vegetable garden. There was sometimes a fountain in the middle. Later, rooms on either side of the entrance, in front of the atrium, but usually connecting with the street only, were built. Between these business rooms was the *ostium*, which was between the door and the atrium. A dog often was chained to the doorway, or *vestibulum*, or a picture of one was painted or worked in mosaic on the floor. The ostium might have costly pavement, statuary, or war trophies. It was a long room. Here clients gathered, wedding processions assembled, or people collected, awaiting a trip to the forum.

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[1] Gulick, Charles Burton. — *The Life of Ancient Greeks,* Chap 3. Appleton.

Gradually the atrium came to be the state apartment, or the place of display, to show the owner's magnificence and

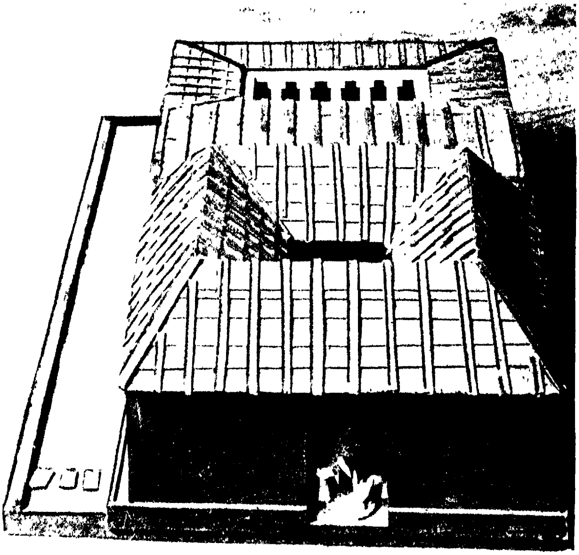

FIG 114. Model Showing the Exterior of a Roman House

wealth. At the entrance were pillars made of marble and in the center was a fountain. Statuary and carving adorned the room. Mosaic floors and walls, painted in brilliant colors or with marble panels, and ceilings of ivory and gold indicated the master's wealth. The rooms along the sides ceased to be bed-chambers, the latter being placed in the second story. These sleeping rooms were evidently considered of little importance, being small and scantily furnished.

Stone and unburned bricks were the first building materials. Dressed stone, covered over with marble, was later used. In classical times, "rubble work," of coarse gravel and concrete, was used. These concrete walls were often faced with stone or kiln-burned bricks. In later days the roofs were tiled.

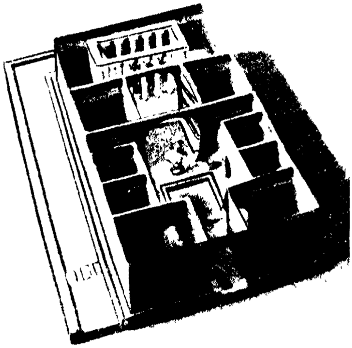

FIG. 115 Model Showing the Interior of a Roman House

In severe weather charcoal braziers were used for heating purposes. Some people of wealth had furnaces, or holocausts, with tiles carrying the hot air to desired places.[1]

Desirable outcomes in Grade IV. From this work the teacher may expect:

1. A rather detailed knowledge of the great variety of houses in the world.
2. A better realization that a house is an adaptation to the climate, to the materials available, and to the habits and occupations of the people.
3. A somewhat detailed knowledge of the conditions that have produced the distinctively American types of houses.

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[1] Johnston, Harold W. — *Private Life of the Romans*, Chap. 6. Scott, Foresman.

4. A very much enlarged interest in peoples of the world, their home life, and their occupations.

5. A general notion of the gradual evolution of lighting and heating houses.

6. A growing ability to appreciate colonial furnishings.

7. A little more detailed understanding of the home life of the Greeks and Romans.

GRADE V

Finding how trees are made into lumber. The work in geography of the United States includes the lumbering regions. Before the work has gone far, statements will be met relative to wastefulness as lumbering has been conducted. These and others will arouse interest in the processes of lumbering and closely related questions. The geographic, industrial, and historic aspects are so closely related that they cannot be separated. The kinds of lumber, the available supply, life in a lumber camp, the wasteful methods of the earlier lumbering activities, the efforts of the government to conserve our forests, the forest reserves, the life of a forest ranger, the cost of forest fires, methods of reforestation, and the annual consumption are some topics which will prove interesting. There is much material available for this study. There are publications which can be secured from the Government Printer, Washington, D C., on forest conservation, production, saw mills, their equipment and operation, gradation of lumber, forest fires, lumber exports, national forests, methods of logging, and pulp-wood consumption and production. Two Farmers' Bulletins, Numbers 173 and 358, by Pinchot, called *A Primer of Forestry*, are especially interesting and helpful in giving a clear understanding of problems related to lumbering. The Bureau of Forest Service maintains a motion-picture film service which makes available to the schools an excellent source of material on lumbering. The processes of lumbering are very clearly given in the book, *Wood and Forest*, by William Noyes. Some children will be interested in reading some of the stories of lumber camps, such as Stewart Edward White's *The Blazed Trail* or Ralph Connor's *The Man from Glengarry*. The National Geographic Magazine for June, 1920, pages 519–536, contains an article entitled "Saving the Redwoods" by M. Grant, which is related to the problems of forestry.

A trip to a lumber yard will assist in the study. There can be seen the kinds of pieces into which boards are sawed. The lumberman may tell where he gets his stock. If possible, go when he is unloading a carload of lumber. In many places there are the ruins of lumbering activity which may be visited. The old flume down which the trees were floated, the pile of sawdust, the old lumber mill by the dam which furnished the power to turn its machinery, the half rotten corduroy road over a swampy place, the decaying logs of once huge trees lying in the tangle of young saplings springing up to replace the waste — all these speak of the days when trees were so plentiful that the sound of a woodman's ax, making a clearing, was a sign of progress, when the forest, where lurked the savage Indian, was thought to be the enemy of man. If such remains exist, they may be visited, in making the impression of former methods to be contrasted with the present spirit of forest conservation.

Such terms as *forest ranger* and *signal tower* should become familiar. The laws relative to camping in forests should become honored. The ways in which the government is trying to save our forests through protection and reforestation should become well known. Consult the Readers' Guide for references to many magazine articles which bear upon these topics.

Making charts showing production of lumber. Find from the World Almanac the facts relative to the lumber production of the various states, with the kinds of lumber produced; the production of the United States as compared with other nations; how long it takes trees of different kinds to grow; and the planting of national forests. Make linear graphs to express these facts. Compare these graphs with those in the geography.

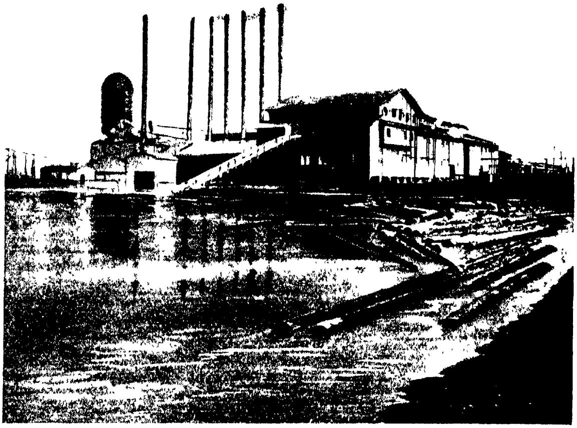
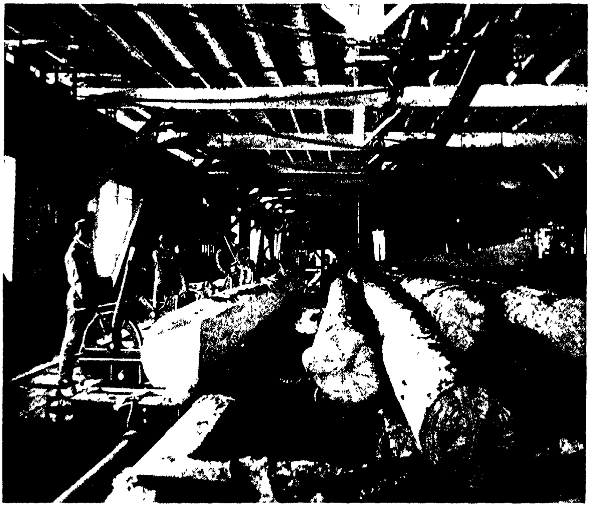

Courtesy Long Bell Lumber Co., Kansas City, Mo

FIG. 116. Logs at the Mill Ready To Be Cut into Lumber

Finding what is the cause of grain in wood. In discussing the kinds of wood, questions will arise as to what the grain is and what are the characteristics of different kinds of woods. Some interesting investigation may follow, including microscopic study of specimens of wood, experimenting in planing a piece of oak to show its grain, finding the difference between ring-porous and non-porous wood, finding what makes wood float, and learning to recognize veneering and imitation in staining and graining wood. The book by William Noyes, already mentioned, gives much material related to those questions.



Courtesy Long-Bell Lumber Co., Kansas City, Mo

FIG. 117 Interior of a Large Modern Saw Mill

Examine bird's-eye maple, quarter-sawed oak, mahogany, black walnut, ebony, and other kinds of wood to note the characteristics.

Take a cube of oak wood. Use a hand microscope and examine the grain on each face. Note on two faces the rows or parts of rings of holes. Note this same in a block of hickory or hard maple. This is seen on a face cutting across the grain. Cut down the grain across a ring at right angles to it in the oak block and note the smooth hard surfaces of irregular shape. These are the medullary rays radiating from the center. It is these hard surfaces that make the beautiful grain in quarter-sawed oak: that is, the log was cut into quarters lengthwise and this exposed the grain.

Connect this study with the wood pulp study suggested in the chapter on Records for Grade V.

Making a model of a castle. The notion of variety in house structure will be enlarged by the study of the structure of a castle and the needs to which it is an adaptation. Read the description in Scott's *Ivanhoe* of Cedric's castle, especially the large room in which the evening meal was eaten on the first night of the story; also the Lady Rowena's rooms, and the bits describing the various parts of Front-de-Bœuf's castle; the dungeon where Isaac was tortured, the tower where Ivanhoe lay wounded during the attack, the towers where the insane Ulrica sang as the castle burned. Chapter XIV of Harding's *Story of the Middle Ages* gives a good description of castle construction. From it the children can

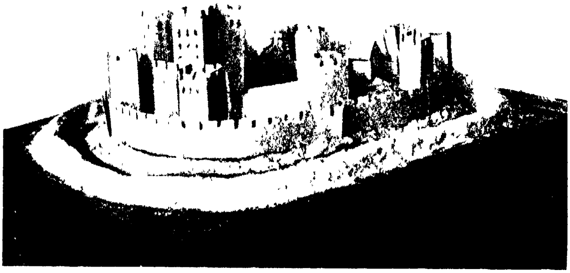


FIG. 118 Sandpaper Model of a Castle and Moat Made by Fifth-Grade Children

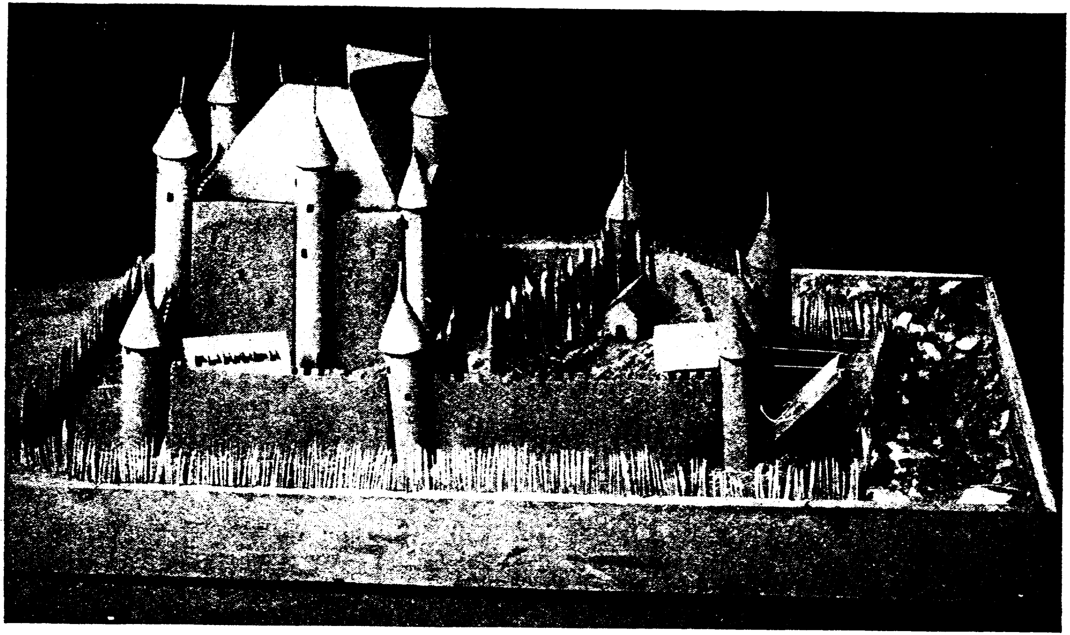


FIG. 119. Sandpaper Model of a Castle by Another Fifth Grade Showing the Drawbridge over the Moat

get ideas for constructing a model in the sand table, using clay or sandpaper. This will serve to explain such terms as *donjon*, *portcullis*, *drawbridge*, *towers*, *keep*, *moat*, *turrets*, and *battlements*. It will show the problem of providing a supply of water during a siege, of keeping the prisoners of war, of hoarding a supply of food, of making the structure as nearly impregnable as possible, and of furnishing protected places for the defenders in which to fight during a siege. See the last paragraph of Chapter II and parts of Chapter III in *Ivanhoe*. The scarcity and smallness of windows will become apparent. The consequent gloom of the rooms will be understood as well as the interest of the returned Crusaders in the dyes of the Orient which made possible the bright-colored rugs and tapestries which they came to use as wall coverings to provide cheer and keep out the chilling winds. Note the size

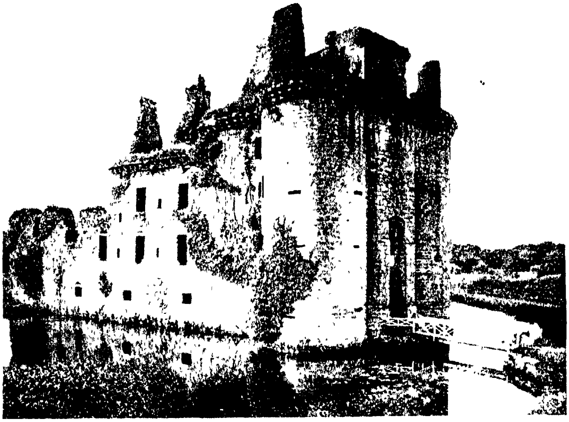


FIG 120. A Norman Castle

of the fireplaces and the amount of wood that must have been burned.

Finding the history of characteristic features in church buildings. Visit some of the most interesting churches of the community — selected on the basis of building features such as stained-glass windows, groined arches, vaulted roofs, and columns supporting the ceiling. Note all the interesting features. Then use histories of architecture, encyclopedias, general histories of Europe, and other available material in the library, for studying the period of cathedral building in Europe. Make a collection of the pictures of the great cathedrals. The National Geographic Magazine for July, 1922, pages 60–114, has excellent pictures. Find what you can about the building of these cathedrals. Consult the Reader's Guide for magazine references to articles about the injuries to the Cathedral of Rheims. Find how stained glass is made. Some children have greatly

FIG. 121. Sweetheart Abbey, Dumfries, Scotland

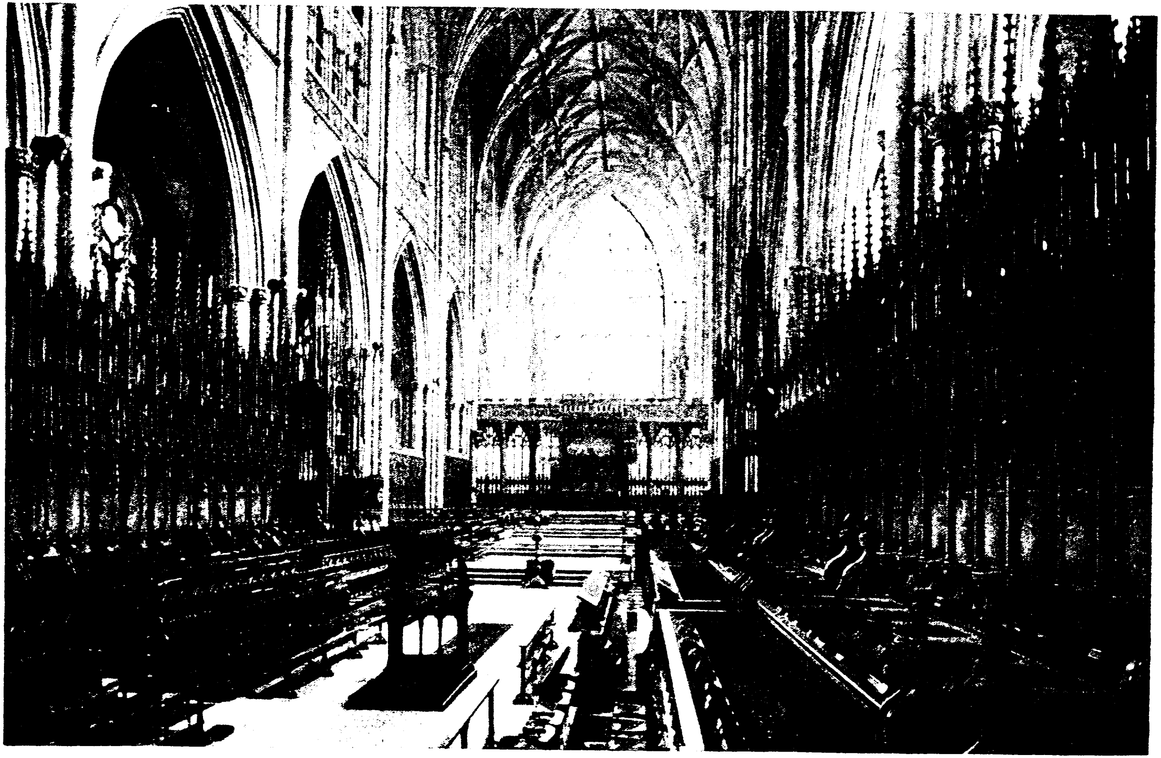


FIG. 122. Choir, York Minster, England

increased their interest in windows by designing a window, and making a representation of it by using black cardboard for the leaded portions and pasting colored tissue paper on this cardboard to represent the colored glass in the design. When this is placed in the window so that the light comes through, the effect is surprisingly good.

Read the prelude to the second part of James Russell Lowell's " Vision of Sir Launfal," and see the cathedral ideas in the frozen brook. Walk through a forest or dense woods, if available, and note the tall cathedral columns of the tree trunks, the groined arches of the interlocking branches, and the blue vaulted sky and the interlacing leaves forming the roof of the great cathedral. One need not remain long in silence before he hears the choir of birds. Read Byrant's "Forest Hymn."

The work should lead to the recognition of the characteristics of Gothic architecture – its spires, and its trefoil and quatrefoil designs in the carving in its choir stalls, altar, pews, and arched window designs.

The decoration of the gloomy stone walls with gorgeous tapestries should be noted. The industry of tapestry weaving gradually became an art. Great religious themes were portrayed in the Biblical stories woven into the designs.

Finding different ways of cleaning a house. Among some American Indian tribes burning a house after a death was an early custom. Explain how this custom may have arisen from their observations of contagion. Compare with our method of removing contagion by disinfecting. Just how is the vacuum cleaner an aid in keeping down the amount of illness? Compare with the use of a broom. Collect descriptions and illustrations of different kinds of brooms, including the turkey wing used for the colonial hearthstone. What effect does sunlight have on germs? Why should one sun rugs? Compare the present custom of using rugs and vacuum cleaner with the earlier custom in some communities of nailing down a carpet, sweeping it, and taking it up every six months and beating it.

Making a bookrack or waste-paper basket. In some schools it may be advisable to encourage the interest in

FIG. 123. Waste-Paper Baskets Made by Fifth-Grade Children

lumber by making it possible for the children to make bookracks or waste-paper baskets. Many designs are available.

Desirable outcomes in Grade V. From this work the teacher may expect:

1. Knowledge about the government's efforts to conserve and replant forests.
2. Respect for forestry laws.
3. An interest in the life of a forest ranger.
4. Knowledge of the lumbering processes.
5. Rather definite knowledge of the present status of our lumber supply.
6. Appreciation of grain in wood.
7. Some ability to recognize different kinds of wood.
8. Appreciation of a castle.
9. Ability to read stories containing details about a castle with more understanding.
10. An interest in tapestry weaving.

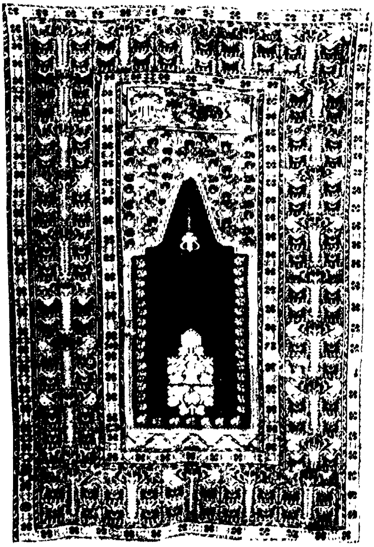
11. Appreciation of the historic significance of church architecture.

12. Some interest in good design and interest in church windows.

13. Greater appreciation of our conveniences in removing dirt.

GRADE VI

Finding what constitutes value in rugs. By this time some work will have been done in rugs sufficient to lay the basis for an interest in them. A rug sale or a magazine article may be the occasion of questions as to what constitutes value in rugs. Collect such advertisements and newspaper and magazine articles about rugs as can be obtained. By this means become as well informed as possible about the different kinds. Then visit a store selling rugs and find out from the dealer the different kinds and their values. Some of the larger department stores carry a line of hooked rugs made in Nova Scotia and New Brunswick. These represent a type



Courtesy Metropolitan Museum of Art

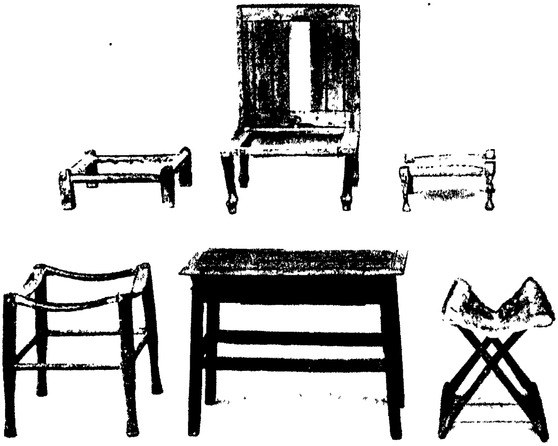
FIG. 124. A Turkish Silk Prayer Rug of the Nineteenth Century

of handmade rug popular in our country a few generations ago. The design was drawn upon the coarse textile which was used as the foundation. A large coarse hook, pointed at the end for punching holes, was used in drawing the yarn or rag strip up through the textile far enough to make a loop. Footstools or small rugs of this kind may be found in the community. Often the colors are very crude and the design stiff and absurd. The rugs made in Nova Scotia and New Brunswick, however, often are lovely in color and design. Some sell for large sums of money. This type of rug represents an American development of an art in rug making which is suggestive of the oriental rug.

Find the characteristics of oriental rugs in irregularity of design and shape, in softness of colors, in durability of quality, and in meaning of design. The Metropolitan Museum of Art, New York City, has printed material which gives pictures, drawings, and descriptions which will help a little in gaining some understanding of the meaning of the designs.

Learning to recognize some of the characteristics of good furniture. Strength of construction, kind of wood, appropriateness to purpose, quality of workmanship, and beauty of design are essential in a good looking piece of furniture. Many designs are interesting in line when thought of apart from the material, but, when thought of in terms of the grain of the wood and consequent strength of construction, are not satisfying. A piece of furniture to be good must be good for something. An element often overlooked is the element of appropriateness to purpose. The piece of furniture must be in harmony with its surroundings. The heavy looking mission furniture crowds a small room. Expensive oriental rugs call for furniture of excellent material and workmanship. A dainty Sheraton chair is inappropriate in a room where there are a number of children playing. Highly polished furniture is not appropriate in a summer camp.

Write to some furniture house for catalogues of their furniture. After becoming somewhat familiar with their types and having gained what information is available upon styles and periods of furniture, visit a furniture store and find the kinds there on sale.



Courtesy Metropolitan Museum of Art

Fig. 125. A Group of Furniture from the Egyptian Middle Kingdom during the Empire Period, from Thebes and Elsewhere—Made of Wood and Rush

This attention to good design in furniture may lead to questions about period furniture, for the children will note such terms as *Chippendale, Sheraton,* and *Queen Anne* occurring in catalogues of superior furniture. Eberlein and McClure's book, *The Practical Book of Period Furniture,* is of great assistance in finding the chief characteristics. As a suggestion of possibilities, some of the chief periods and some of their outstanding characteristics are here given.

Jacobean, 1603-1688. The material was usually oak, but walnut was used in the latter part of the period. In general characteristics the furniture was stout and heavy, even to clumsiness, with a predominance of straight lines, and with a tendency toward squattiness. Stools and benches were more common than chairs. The occasional chairs were fitted with high seats, heavy stretchers between the legs, high and stiff paneled backs, quite suggestive of choir stalls —

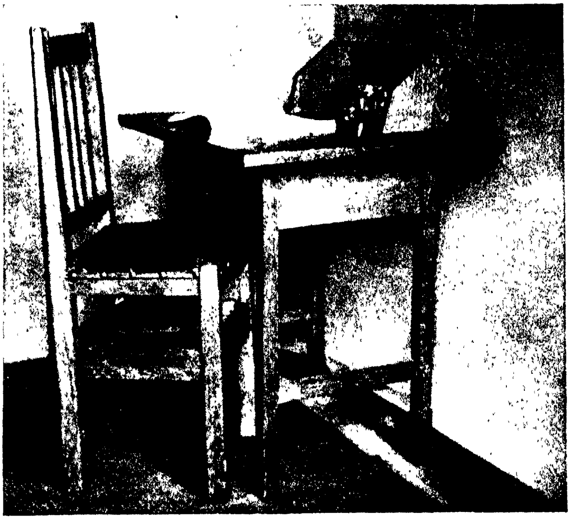
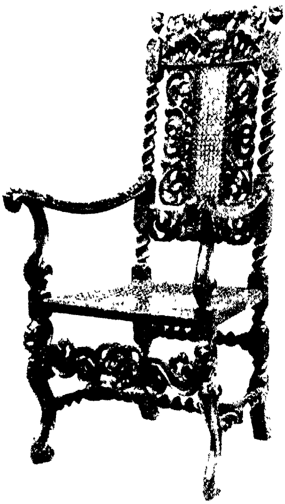


FIG. 126. Furniture Made by Upper Grade Children

the whole expressing severity and dignity. The legs and stretchers were often turned. Frequently the former were bulbous. Carving was much used. See Fig. 127.

William and Mary, 1688–1702. The material usually was walnut. The period was characterized by hooded tops, cup-turned legs, often inverted cups, shaped stretchers, and aprons — the down-hanging piece of wood across the front as if to hide construction. There is a tendency to refinement and simplicity. The love of color, a style introduced by the Queen, showed itself in the use of lacquer, marqueterie, painting, gilding, and upholstering textiles. Marqueterie is a form of elaborate inlay confined to wood. The legs were often hoofed or clawed. Carving was less used than in the previous period, although still much used, as shown in Figures 128 and 129. The furniture reflected the Dutch influence.

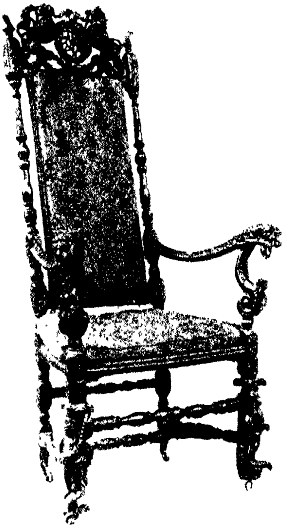


Courtesy Metropolitan Museum of Art

Fig. 127 Late Jacobean Chair of Walnut

In the style of Charles II, known as the Restoration Period, 1680–1685.

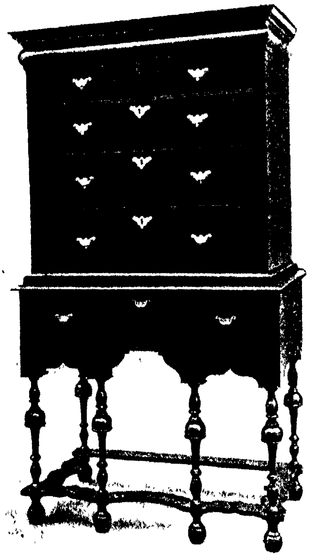
Queen Anne and Early Georgian, 1702–1750. The materials were usually walnut or mahogany. The outline seems characterized by the use of the *cyma curve,* a double curve somewhat like a flattened letter s. Two such curves in combination, at one angle, gave the line for the back of the chair, at another angle the tops of secretaries or cupboards, and still another angle the skirts of certain pieces, while one curve gave the line of the cabriole leg. Elaborate carving also was used, the knees of cabriole legs being adorned with eagle heads; later with lions' heads, and still later by grotesque satyr-masques. The feet of the legs were carved into clawed, clubbed, or hoofed effects. The use of stretchers is little found in this period. The chair backs were somewhat lower than in previous periods. The central part of the back of a chair is called the *splat*. In this period the splats were usually fiddle-shaped and the seats rounded. See Fig. 130. Figure 129 is an American highboy of this period. Note the inverted cups and cyma curves.



Courtesy Metropolitan Museum of Art

FIG. 128 A Chair of the Restoration Period In the style of James II, 1685–1689

Louis XIV, 1642–1715. The material was oak and walnut. The structural lines were vertical and horizontal, giving a tall, perpendicular aspect with an element of severity. The furniture of this period is characterized by dignity, even to the pompous, and by magnificence, elegance, and profusion of ornamentation. There was much use of veneering, gilding, painting, lacquer, and metal and tortoise-shell inlay, as well as of rich upholstering. The decorative motifs included cupids, wreaths, busts, satyrs, and doves. The seats of the chairs were approximately square. See Fig. 131.



Courtesy Metropolitan Museum of Art

FIG. 129. An American Mahogany Highboy of 1710–1720

Reflects the William and Mary Period influence through the inverted-cup turned legs

Louis XV, 1715–1774. Walnut, oak, and mahogany were used, the last more than in any previous period. In contrast with the Louis XIV furniture, that of this period is characterized by extreme curved structural lines. Legs, arms, and frames of chairs were carved elaborately. The seats were broad and nearly square, tapering slightly toward the back. The arms of the chairs were short and flaring, the supports to the arms meeting the seat far back. The backs were broad, arched a little, and carved. Bedsteads were characterized by draperies and canopies over the head rather than by posts. Tables often were made with not a straight line except the top. As in the previous period, much use was made of inlaying, veneering, painting, and upholstering. The decorative motif included rocks and shells — the " rococo " ornamentation. It was a formalized attempt to express a tendency to the rustic. Wreaths, busts, satyrs, doves, cupids, and fountains again were much employed. See Fig. 132.

Chippendale, 1740–1780. Mahogany was the characteristic material, with some use of satinwood. In general, Chippendale's furniture is characterized by strength and solidity combined with grace and beauty. It appeared strong and was so. Because of the use of mahogany instead of walnut the heaviness of preceding types was displaced by lightness and grace. His work falls under four sources of inspiration, for he was most skilled in adapting styles to his standards of excellence. The first phase of his work is characterized by the traits of his English predecessors. In this period he used as motifs lions, masques, egg-and-dart for moldings, claw-and-ball, and acanthus leaves. He retained the cabriole leg, clawed foot, and hooped-top back. See the chair in Fig. 133. The second type was marked by the Gothic influence, where he used pointed arches and

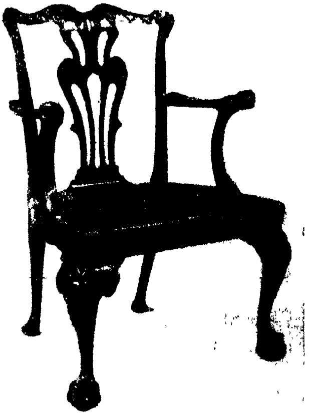
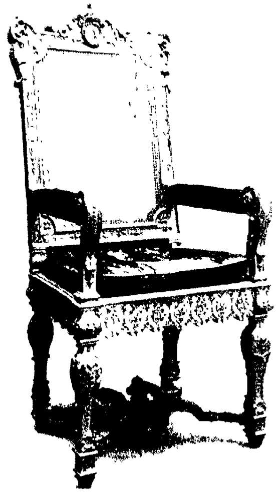

Courtesy Metropolitan Museum of Art

FIG. 130 A Mahogany Chair of the Early Georgian Period

quatrefoils for motifs. The Gothic pillar and fretted designs are characteristic. The third type is French, using the shell and rococo motifs. The fourth type is Chinese, with pagoda details for motifs.

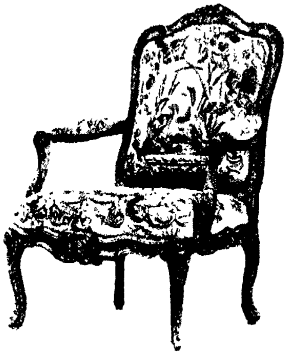


Courtesy Metropolitan Museum of Art

Fig. 131 A Chair of the Louis XIV Period

The chairs characterize his work perhaps more than the work of any other designer. The seats were angled at the front corners and broader in front than at the back, giving an open, generous effect. The backs were greatly varied, tending to be fretted and interlaced in effect, as contrasted with the solid splats, or panels, of Queen Anne's time or the pierced splats of the Early Georgian. They included pierced, splatted, flat-hooped, ribband, ladder, Gothic pillar, bar, and fretted backs. With the change from the cabriole legs of his earlier period to straight legs, he used stretchers. Along with this was the introduction of squared backs to supplant hooped backs and the making of the back legs continuous with the uprights of the backs. See the chair in Fig. 133. Note the cabriole legs, hooped back, and back legs separate from the back. It is a chair of his earlier work. Contrast with the chair in Fig. 134, noting the squared back, straight legs, and back legs and back continuous. In all his furniture carving was used as the decorative element.

Adam Brothers, 1762 1795. The Adam brothers used mahogany, but in addition satinwood and other lighter woods, which hitherto had been used for inlay only. The general characteristic of their furniture was straight lines, almost to angularity, which was obviated by the lightness and grace of the design. Legs were usually slender and tapered. Chair seats varied in shape. Backs of chairs often were oval or circular, usually with radiating spokes. For decorative purposes, use was made of carving, turning, inlay, marqueterie, veneer, painting, gilding, and Wedgwood plaque insets. The Adam brothers gained motifs from the classic style, using urns, reeding, wreaths of flowers, festoons of drapery, or husks caught up by rams' heads, knots of ribbon, and drops of bell flowers.

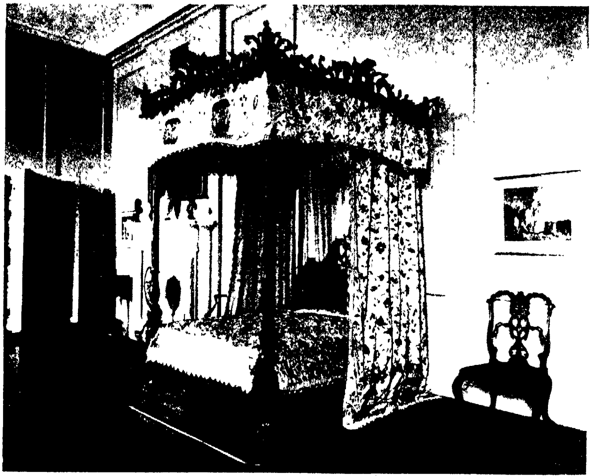


Courtesy of Metropolitan Museum of Art

FIG. 132. A Chair of the Louis XV Period - Walnut and Tapestry

Hepplewhite, 1765 (?) 1786. The material generally used was mahogany. Hepplewhite also made much use of lighter woods such as the Adam brothers used. Hepplewhite's work was characterized by grace, lightness, and beauty of contour. His work is similar in many respects to that of Sheraton but differed in this, that where he had concavity in the front of drawers and chests, Sheraton had convexity.

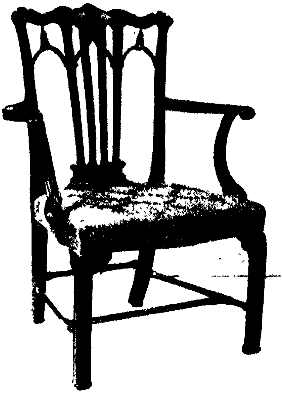
The Adam brothers, Hepplewhite, and Sheraton used straight legs, usually slender and tapering. The backs of Hepplewhite's chairs were usually shield, hoop, or interlacing heart backs, the shield being quite characteristic. The backs are usually supported by extensions of the two back legs, which are slightly curved as they rise to uphold the back. See Fig. 135. The tapering legs usually were squared with spade or block feet. The decorative methods include painting, inlay, marqueterie, turning, gilding, and veneering. He preferred painting to inlay. He used classic motifs foı his designs, including acanthus leaves, pendant husks, rams' heads, and flowers. Reeding, fluting, rosettes, and ribbands were also used. Especially distinctive motifs were Prince-of-Wales feathers, ears of wheat, and the lyre.



Courtesy Metropolitan Museum of Art

FIG. 133. Chippendale Furniture

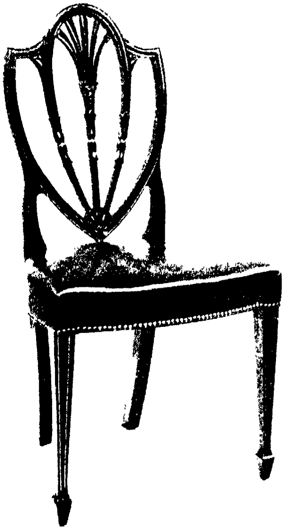
Louis XVI, 1774–1793. Materials in this period included mahogany, walnut, oak, and satinwood, as well as all known ornamental woods. Every process suitable for ornamentation was employed, free use of wonderful Beauvis and Gobelin tapestries being made. Where tapestries were used for seats and backs, the inclosing or framing wood was intricately carved. The contour lines are rectilinear as are those of Hepplewhite, but especially those of Sheraton. The latter was much influenced by the Louis XVI furniture. There was a marked influence of classic design. The chairs tended toward squared backs. The arms were at right angles to the backs and supported by straight, upright extensions of the front legs, or they constituted a curve continuing from the back. If the latter, the supports were curved. The legs were straight and tapered.



Courtesy Metropolitan Museum of Art

FIG. 134 A Chippendale Chair of the Gothic Type, 1760–1765

Sheraton, 1750–1806. The material was usually mahogany and satinwood. Sheraton's furniture stands as the exponent of straight lines. The fronts of chests and drawers were convex. Slenderness and narrowness of contour with simplicity of outlines is a prominent characteristic, so that perpendicularity seems to be the salient feature. He was much influenced by the Louis XVI style. He was a champion of inlay as opposed to painting as a decorative process. Dignity and refinement together with delicacy of outline and detail are his. The structure of his furniture is stronger than appearance would indicate. He was ingenious in devising hidden compartments and his furniture was often made to serve a double purpose. See Fig. 136.

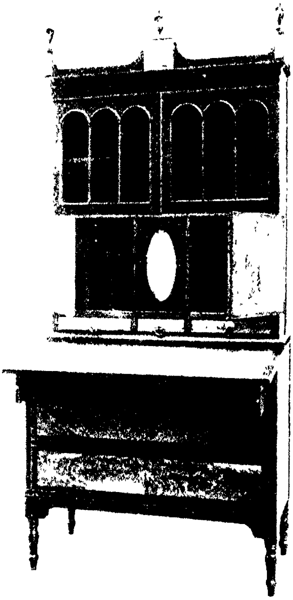


Courtesy Metropolitan Museum of Art

Fig. 135 An American Chair Showing the Hepplewhite Influence

Empire, 1793–1830. Usually the material was exceptionally fine mahogany. Some writers have said it "lacked dignity, refinement, grace, originality, and spirituality." The furniture was elaborately ornamented with brass. Its characteristic motifs were lions' and bears' claws, pineapple, acanthus leaves, pillars, wings, cornucopias, shields, swords, war trophies, stars, and bees. The letter N, for Napoleon, was in evidence as a design motif. In contour the furniture was heavy, cumbersome, rectangular, even bulky. Legs were straight and turned. There was some use of upholstering, which was heavy in color and pattern. Carving, turning, veneering, painting, and gilding were used as decorative means. The finish was a very high polish, reddened.

Summarizing the kinds of building materials in use. Wood has been somewhat thoroughly studied in the fifth grade. The lack of enough wood has led to interest in other materials. Then, too, the demands of modern civilization call for fireproof material and that which is very strong.



Courtesy Metropolitan Museum of Art

FIG. 136 An American Desk and Bookcase of Satinwood in Sheraton Style, 1800

Concrete and cement construction are becoming very familiar. The booklet, entitled *Concrete Construction*, published by the Atlas Portland Cement Company, 25 Broadway, New York City, is very helpful in suggestions and directions for using cement. Window boxes, bird baths, sun dials, sidewalks, and many other things will be suggested to the children as possible things they can make. The making of a collapsible form for a flower pot is not only an interesting experiment but furnishes another illustration of ways of shaping plastic material. Find from encyclopedias or other sources how cement is made.

The use of steel in reinforced concrete construction should be a matter of consideration. If possible, visit a piece of reinforced concrete construction work in process. The further use of steel frames in constructing tall buildings should be made as clear as possible. Magazine articles and advertisements will help in this. A very suggestive article on "Industry's Greatest Asset — Steel," by J. Showalter, may be found in the National Geographic Magazine for August, 1917. It is quite helpful in gaining some notion of the use to which steel is now put in the building industries.

Attention should be called to the recent tendency to substitute asphaltum, asbestos, tile, or composition shingles for wooden shingles; to substitute metal or other prepared lath for the wooden lath; to the use of stucco for weather boarding; and similar substitutions.

In the matter of earthen materials, note the substitution of concrete blocks and hollow tile for brick. By way of impressing these changes, find the cost of flooring a garage with brick, with cement, and with stone flagging; or find the cost of a brick foundation, a stone foundation, or a concrete foundation for a house. Which material is used the most to-day? Why?

Considering the harmony of house furnishings and decorations. By this time, the various articles used in furnishing the house should have been studied in some detail — floor coverings, wall coverings, window curtains and shades, tables and chairs, and other appropriate furnishings for each of the respective rooms. Some time should now be given to consideration of the relationships ot these various elements of interior furnishings and decorations to each other. The floor coverings, wall coverings, furniture, and other decorative features of a room should all form an harmonious unity in both form and color. Rooms opening into each other should not present contrasts that are very great, if they are to be used together. Visit some homes to find how far unity is usually secured. If possible, visit several rooms which are decorated and furnished in excellent taste. Note how completely everything seems to belong with everything else. For rooms that are finished but bare of furnishings, make selections from stores with which to furnish them as you would if they were your rooms. Such practice as this is an excellent means of cultivating judgment and taste. If your class can help really to furnish one or more rooms, it will be well worth while to do so. This work is a fine test of the art values taught all through the elementary school with reference to furnishings and interior decoration.

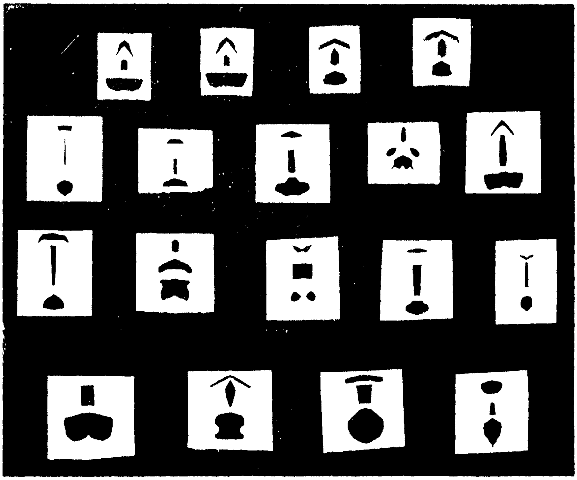


FIG. 137. Class Designs for Wall Paper Stencils

Finding whether it is cheaper to rent or to own a house. Find the price of a house and lot of desirable type. Find the interest on this amount of money at borrowing rates, the taxes on the property, the insurance, the upkeep, and the estimated deterioration on the property per year. Find what the rent of such a place would be. Which is the cheaper? Why own a house? Why rent?

Desirable outcomes in Grade VI. From this work the teacher may expect:

1. An increasing appreciation of rugs and furniture.
2. Some ability to judge good quality in rugs and furniture.
3. A rather definite knowledge of different materials used in building to-day.
4. Some judgment as to the cost of a house and its maintenance.
5. Knowledge of the outstanding characteristics in period furniture.

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Valuable for those who need help on wood construction.

KINNE, HELEN, and COOLEY, A. M — *The Home and the Family.* Macmillan.

Contains helpful suggestions on furnishing, sanitation, and cleansing of the home. Can be used by children of the upper elementary grades.

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A very detailed account of logging, saw milling, wood hand tools, and processes in construction. Excellent illustrations.

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WINSLOW, LEON L. — *Elementary Industrial Arts.* Macmillan.

Chapters 4, 6, 9, 11, and 12 treat of brick and tile, cement and concrete, iron and steel, glass making, and woodworking. The discussions are well illustrated.

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Well-illustrated, authentic descriptions. Excellent reference for children.

CHAPTER X

SUGGESTIONS FOR THE STUDY OF UTENSILS

GRADE I

Playing with clay. When a child first is given clay he takes great delight in just manipulating it. He has no purpose. He makes no plans. He enjoys handling it because he finds it a plastic material, easily manipulated. He soon ceases to look upon it as dirty.

Making dishes and flowerpots for the doll house. From the handling, the child soon begins to make shapes of things about him. The teacher here should guide his selection to objects that will prove stimulating to further effort. He may make a boat of clay, but it will not float and loses its shape when put into the water. It is better to guide him into making dishes and flowerpots for the doll house. He will find that he is doing what really is done — making dishes and flowerpots of clay. To make them more usable, after the clay is thoroughly dry, one may put the dishes and flowerpots into an iron kettle with an iron lid and bury the kettle in the coals in the hottest part of the furnace, where they should remain a day. This will harden the flowerpots so that they really can be used. The dishes will not hold water because they are not glazed.

Finding out how dishes and vases are made to hold water. Examine the dishes made. Compare with some that came from the store, noting the glaze on the latter. Get some pieces of broken dishes and note how thick the glaze is. Note also that all but the glaze looks like the dishes made by the children.

Visiting a pottery. If there is a pottery in the community, visit it. See the men making the pottery, note the sheds where the pottery is drying, watch the men stacking a kiln, and watch a kiln which is being fired. Especially interesting is it to watch the man who is dipping the pieces in the glaze material. Usually in cheap ware, like crocks and jugs, the pieces are glazed after the drying, before the firing. In more carefully made pieces, like table dishes, the pieces are dried, fired, glazed, dried, and then fired again. Watch the man put the line on the jug near the top. Or sometimes he dips the lower part of the jug, up to the shoulder, into one tub of glaze and the upper part into another tub. Go to the pieces of fired ware which are ready to sell and see how they look. The lower part of the jug is brown and the upper part is white. There must be some difference in the two tubs of glaze.

Visiting a china store. These differences in glaze should call attention to the fact that dishes are decorated with many colors. This can be better understood if the children tell the colors of the dishes they have in their homes. Some may have vases for flowers, made of clay and decorated in various colors. It is advisable to visit a store selling dishes and note the great variety in sizes and shapes. Call attention to the many ways in which they are decorated. Some have lines painted on and some have patterns stamped on in a manner similar to the way we put a picture on an Easter egg. The great numbers of dishes exactly alike in size and shape should be noted also. Ask the merchant to show how the dishes come packed.

Visiting a clay bank. By this time the children will have asked more than once what clay is. Visit a clay bank where the clay is secured for the pottery, if possible. Or a bank of clay, not so used, may be visited. Note the thickness of the bed of clay. This clay is soaked in water in a large vat until it can be stirred into a creamy liquid. This is strained to take out sticks and stones. If it then is allowed to stand several days, the water can be poured off. The clay can now be dried until it is in a condition to be molded.

There are different kinds of clay — some red, some gray, some blue, and some yellow. Some is wet when dug from the ground. Some looks like rock but is so soft that it can easily be rubbed into a powder. The finer qualities of clay are used for dishes, the coarser for bricks and sewer pipe.

Making May baskets or baskets for Easter eggs. Secure some cat-tail rushes, some palm leaves, or other vegetable in coarse strips. If none of these is available, cut strips of tough paper one-half inch to an inch wide. Pieces twelve or fourteen inches long will be a good length. Weave the base of the basket by the over-under process, allowing the ends to extend. When the base of the desired size is secured, push the strips closely together, then bend them upward at right angles to the base. Take a long strip and weave in and out around these upstanding strips, creasing the corners. Finish this by weaving far enough around the second time to tuck the end in securely. Push this first strip woven in, down close to the bottom. Weave in another strip, and as many more as are desired, being sure you go outside of the spokes of which

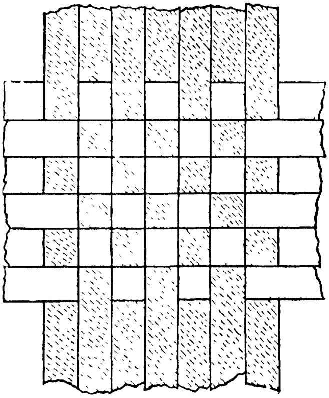


FIG. 138 Showing the Method of Weaving the Bottom of the Basket

you went inside the last time around. When the desired number of rounds have been made, leave the two middle upstanding spokes on each side. Cut the others so that they extend above the weaving a length nearly twice the width of a strip. Bend each spoke down so that it weaves down into the basket and the end disappears. To strengthen the edge a second strip can be woven around, immediately over the last one, before the spokes are turned down. To make the handle, braid the four remaining spokes so that they interlock. Bind the resulting handle with another strip wound around and around, fastening in the ends securely.

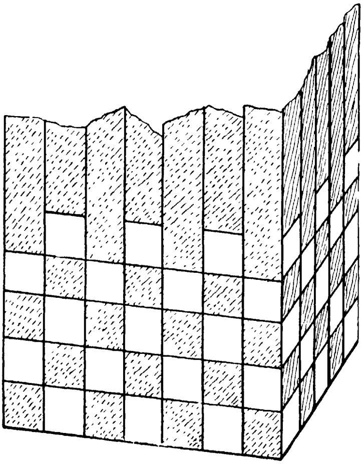


FIG 139 Showing the Method of Weaving the Walls of the Basket

If vegetable materials are used green, they will shrink when dry and leave a very loose basket. So, if a basket that is more than temporary is wanted, dried vegetable material should be used. Just before using, soak the material in hot water to make it flexible.

Examining baskets. Compare the basket just made with such baskets as are available. Many will be found made by this weaving process, but it will be seen that there are a number of others which are sewed.

Listing the uses of baskets. Make a list of the uses for baskets and of the materials of which baskets are made. This will tend to increase interest in baskets. An attractive collection may be made by the children if desirable.

Making candy boxes for Christmas. Using tough paper, cut and fold into the shape of a box, tying at the corners with ribbons. Various shapes can be made, once the children get the idea.

Comparing paper boxes, baskets, and dishes. Dishes hold water. They are heavy and hard and will break if dropped. Baskets are lighter. They usually do not hold water. If made of vegetable fiber, getting wet will not injure them. They do not break when dropped. Paper boxes are light but will tear and are ruined if wet.

Desirable outcomes in Grade I. From this work the teacher may expect:

1. Acquaintance with clay as a very satisfactory material to use in making things because it is plastic
2. Knowledge of where clay comes from and a little of how it is prepared for use.
3. A rather definite idea of the essential processes in making dishes.
4. The beginning of an interest in dishes.
5. Greater care in handling dishes.
6. Some respect for fine dishes and interest in their decoration.
7. Awareness of some of the kinds of baskets.
8. An interest in how baskets are made.
9. Some notions of the fundamental differences between dishes, paper boxes, and baskets, and the consequent care they should have.

GRADE II

Washing dishes. The dishes used for luncheon need washing every day. There should be a luncheon cupboard, or shelves in a cupboard for keeping the dishes, crackers, paper napkins, and whatever equipment there is for luncheon. The purpose in washing dishes should be taught - not only to make them clean but to remove everything that will cause them to be unsanitary. The methods used at home can be discussed in finding the best ways of cleaning them. The use of hot water and soap, followed by rinsing, will be adequate for ordinary conditions, but if there is a contagion prevalent the only safe thing is boiling the dishes. Boiling usually detroys germs. This will raise questions as to care in handling dishes. The fact that hot water poured on a dish may break it, while putting such a dish into hot water will not, should be explained, telling of the expansion under heat, and the consequences when one part is subjected to great heat while the rest of the dish is not. Attention should be called to the danger of breaking a dish if set flat in a pan of boiling water over a flame.

Placing dishes in the cupboard. Ideals of neatness and orderliness should be taught in the putting of the dishes away each day. Accessibility of dishes, classification and arrangement into kinds, and attractiveness as they appear on the shelf should be held up as standards.

Arranging the luncheon table attractively. It is worth the time it takes to teach the children to like a neat, attractive luncheon table. Proper placing of the dishes is important. Attention should be called to the importance of using only such bouquets as harmonize with the dishes and foods in color schemes. To most persons nasturtiums are not attractive in a red dish. Simplicity should be emphasized. The correct positions of the knife, fork, spoons, plate, and glass should be taught.

Making a list of all the things in the home made of clay. To extend the children's conception of the uses of clay, it may be well to lead them to make a list of all the things in the home made of clay. It can be illustrated with pictures of the various articles, some of which can be cut from magazine advertisements. The list may include dishes, crocks, jugs, vases, tiles, sewer pipe, brick, some kitchen and bathroom fixtures, and sometimes electric fixtures or furnishings.

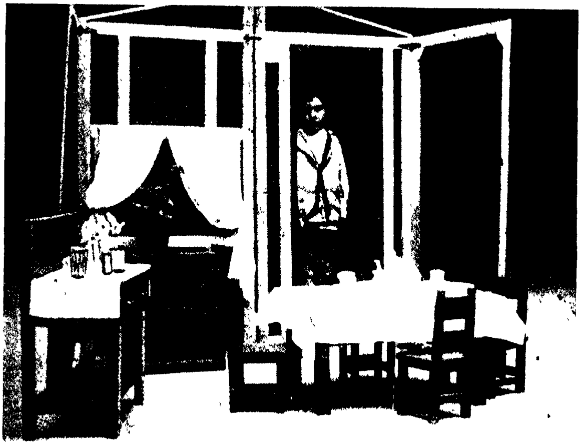


FIG. 140. The Luncheon Table
The screen arranged as a dining room using the furniture made by the children.

Making a glazed vase. No technique need be taught. The children will shape the clay in their own way. If a kiln is available, these vases should be glazed with prepared glazes. These can be purchased of B. F. Drakenfeld, 50 Murray

Street, New York City. In buying glazes, the possible firing temperature of the kiln should be known. One should select the glaze that will fuse at that temperature. To apply the glaze, mix the dry powder with water to the consistency of medium heavy cream. Add a teaspoonful of gum arabic solution to make it sticky and a teaspoonful of gum tragacanth to make it flow smoothly. Apply with a small soft brush, using a lapping stroke — lap the glaze on. The glaze mixture should be applied until about a sixteenth of an inch thick. It should not be applied until the vase is thoroughly dry. After it has been applied, the glaze should be thoroughly dried before the vase is fired. In placing in the kiln set each piece upon a tripod, because the glaze will tend to run down and this will make the vase stick to the floor if not so placed. The tripod touches the vase at only three points. Examining the bottoms of dishes will show some with tripod marks. Others have a rough "sanded" edge or rim upon which they have sat in the kiln. In such, it is evident that the glaze must have been very carefully put on.

Seeing the vases fired. If possible, the children should visit the kiln when their ware is being fired. Many questions will be raised which should be answered to organize what will be seen.

Summarizing the processes in making a vase. The clay is (1) dug from the ground, (2) soaked to a slush, (3) strained through a wire screen, (4) allowed to stand until the clay settles and clear water can be drawn off, (5) pressed and otherwise dried until plastic, (6) shaped into a vase, (7) dried into what is known as green ware, (8) glazed, and (9) fired. If the vase is very fine, it may have two or three firings. The dried clay vase is called *green ware.* When fired it is known as *biscuit ware.* When glazed and fired it is called *glazed ware.* The three-firing process is described in Grade VI.

Many pieces are spoiled or injured in firing. The glazed ware is sorted into *firsts, seconds,* and *chuck.* In sorting, each piece is struck to see if it rings and is therefore sound. Near a factory making jars and crocks, one may hear the cheery ring as the workman is busy striking each piece to see if it is sound. The chuck is used for road grading or some such purpose. Seconds are sold at prices somewhat less than those received for firsts.

Making a collection of pictures of vases. Children often need to have modified their notions of what is beautiful in vases with respect to form and color. The building up of likings for the good comes through contact with the good. One way then is to interest them in finding as many pictures of beautiful vases as they can. Magazine advertisements will furnish many. Discussion of the kinds of flowers to which the different shapes and sizes and colors are suited is helpful. The teacher should try to have in the room, available for flowers, several vases simple in line but differing in color and size and shape. The decision as to which vase is most suited to a bouquet is a very profitable way of learning, if it is based upon group judgment.

Discussing how people may first have made pottery. Children will raise questions as to how people learned to make pottery. This should be talked over with them. They should be told about the work of anthropologists in trying to find how people lived before histories were written. This will lead them to see that we can only find the earliest possible ways, and surmise from what we find. By comparing the ways in which people now living make pottery, we can see differences between the ways of the less civilized and more civilized peoples. Read the myth of Grandmother Kaolin, found in *Cat-Tails and Other Tales*, by M. H. Howliston, published by A. Flanagan. It gives what some people have thought might have been the beginning of pottery-making. Compare with the suggestions in *Early Sea People*, pages 149–153, by Miss Katherine Dopp.

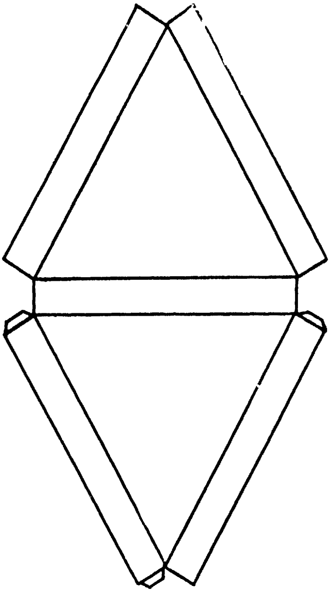


FIG. 141 Pattern for a Candy Box

Making Easter and May baskets. Baskets may be made for Easter and for May Day as was suggested in Grade I. No new technique should be taught.

Finding out about the beginnings of basket making. Basket making processes are very old. Practically all peoples make them, even those of rather low types of civilization. Read from Katherine Dopp's *The Tree Dwellers*, pages 106–111, and from *The Early Cave Men*, pages 126–142, the story of the beginnings of basket making as told in these books. The materials were vegetable such as grasses, reeds, strips of bark, willow branches, roots, strips of palm leaves, cat-tail rushes, and pine needles. There are two fundamental processes — (1) sewing or wrapping, and (2) weaving, with a possible third method of shaping and sewing bark.

Finding the extent to which basket materials are used in a home. Make a list of all the things used in the home which are made of these basket materials. The list will include chairs, tables, parts of lamps, couches, trays, swings, hampers, parts of phaëtons, and baby buggies, as well as baskets. What is the predominant fundamental process in their construction?

Finding how paper and cardboard boxes are constructed. The children will want to make boxes for Christmas candy. Bring together a number of different paper and cardboard boxes and find how they are constructed. Find the various ways of making the corners strong, making the boxes more or less air-tight, and decorating them. All paper boxes have a stiff body, usually of cardboard. These are cut of one piece so shaped as to fold and make the top, bottom, and four sides. The top is sometimes separate. There are various ways of fastening the corners. Sometimes they are glued, a lap having been allowed at each corner, in the cutting. Sometimes they are reinforced and held together by a strip of gummed cloth. Sometimes wire brads or clips hold the corners, or strips of metal fasteners may be used. Often this foundation box is covered with a decorative paper.

From this investigation the children will have many ideas for their Christmas boxes. They should be encouraged to follow good construction methods.

Desirable outcomes in Grade II. From this work the teacher should expect:

1. Correct method of dish washing.
2. Ideas of sanitation in dishes.
3. Ideals of neatness and attractiveness in arranging dishes in a cupboard and in laying a table.
4. An extended appreciation of the significance of clay.

5. Some knowledge of the fundamental processes involved in making a vase.

6. An appreciation of vases, and interest in them, and some taste in the selection of vases appropriate to their use.

7. Some basis of thinking about the beginnings of pottery.

8. An interest in baskets.

9. Some understanding of one fundamental process in basket making.

10. Knowledge of some of the kinds of materials that are used in basket making.

11 Knowledge of other things that are made of these materials.

12. Insight into cardboard box construction enough to understand the fundamental processes in shaping boxes.

13. Greater appreciation of beauty in color, design, and material used in vases, boxes, dishes, and baskets.

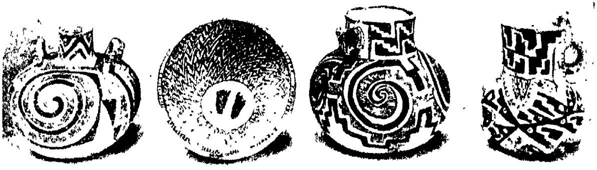
14. Some realization that basketry is a very old industry and has not greatly changed.

GRADE III

Collecting Indian pottery or pictures of such pottery and of the designs used by the Indians. Bring together as many pieces of Indian pottery as can be secured. Supplement these with as many pictures of Indian pottery as are available. Compare these, noting the colors and characteristics of the designs. Find the meanings of these designs. The book by Jennie Hall, called *Weavers and Other Workers,* on page 93, gives the key to some of the designs. Compare the designs on the pottery with the designs on the blankets and in the baskets. See Figs. 34–40. Note similarities in motive, line, and rhythm. The Indians of the Southwest were especially noted for their pottery. Consult the book by P. E. Goddard, entitled *Indians of the Southwest,* published by the

American Museum of Natural History, Handbook Series No. 2, for details of the lives of these Indians. Some of them achieved a high degree of proficiency in pottery-making technique. They had, however, very inferior methods of firing their products and seem to have done little toward perfecting waterproof pottery.

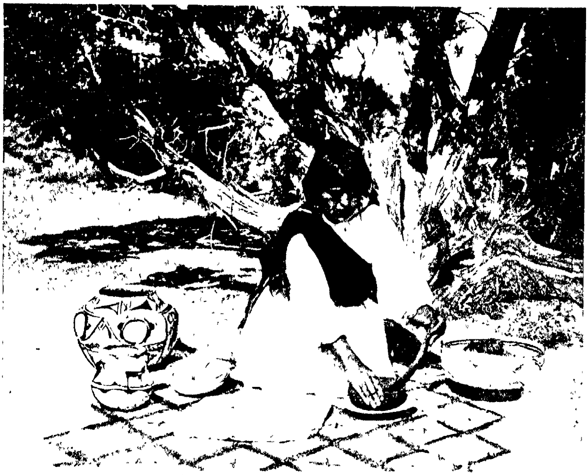
Finding the uses the Indians made of pottery. The Indians used their pottery for dishes, cooking utensils, containers for storing food, and for water bottles. The Indian olla was made on the same principle as some of the so-called iceless refrigerators, or coolers. The wall was slightly porous, just enough to keep the surface damp. In the dry climate of that southwest country this moisture evaporated, having a cooling effect, as will be noted if you hold your arms when wet in the air.



Courtesy American Museum of Natural History

FIG. 142 Indian Pottery from New Mexico

Much that we know of early civilization in this country has been found out by archæologists. One method of their work is to find a mound which evidently is not a natural mound of earth. They dig down through it, noting carefully what they find as they proceed downward. They save every specimen and note just how far down it was found. This mound is probably the ruins and débris of an Indian village which has long since fallen into decay after many successive generations have lived there. Each generation has discarded trash, bones, bits of broken tools, and things no longer wanted, along with dirt and ashes. So the mound has come to be a record of the past. If the houses were made of adobe or clay, as houses in the Southwest often have been made, the decay of these houses adds to the accumulation of dirt.



Courtesy Museum of the American Indian, Heye Foundation, New York

FIG 143 Zuñi Woman Applying a Coil in Making a Vase

In such excavations in the Southwest, it is usual to find the chief specimens in this accumulation of dirt to be pieces of broken pottery. In contrast with this, in some parts of New York State searchers in the débris reveal, not broken pottery, but flint chips, pieces of arrowheads, spearheads, stone hammers, and scrapers—often good ones lost by the workers. What do these contrasts suggest as to differences in the lives of the Indians of the Southwest and of some parts of New York?

By comparing the different pieces of pottery found in the ruins with each other, degrees of civilization can be determined — especially when they are in turn compared with the pottery being made to-day by people of varying degrees of civilization.

Finding how the Indians made pottery. Read such accounts as are available, describing the Indian method of making pottery. A coil of clay was made by rolling, by means of gentle pushes on a smooth surface, a long piece of clay that had first been made as round as the hands could make it. When the coil was of a diameter varying from one-half inch to one or more inches according to the kind of piece to be made, it was coiled around and around from the center out, to form the base, and the process was continued, one coil being piled upon another to form the walls. After it was piled up in coils, the worker went back over the coils and rubbed them together, so that the whole thing became one piece.

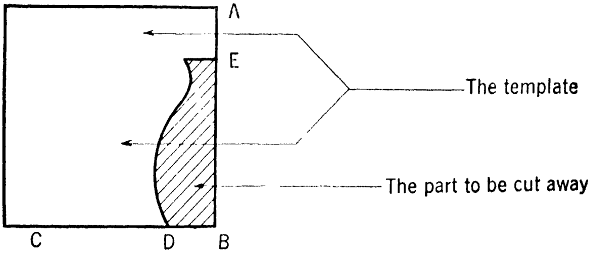


FIG. 144 A Template Used in Coil Building

Making a bowl by the coil method. *a. Making the template.* Our potters do not build with the coil method exactly as the Indians did, and their way is easier for novices than is the Indian way. As an aid in making the profile of the wall the same on all sides, cut what is called a *template* from a very tough piece of cardboard. Be sure that the vertical axis of the vase-form space is at right angles to the base of the template, and further, be sure that there is plenty of base beyond the outline of the vase.

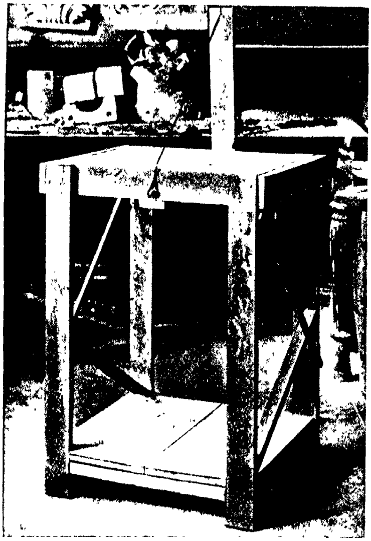


FIG. 145. A Wedging Table

b. Wedging the clay. To make the clay more plastic so that it will not crack when being used, *wedge* it thoroughly. To wedge clay, throw it forcefully upon a hard board surface or upon a marble or stone surface. If a wire is stretched from the front edge of the surface to the top of a vertical stick at the back of the surface, the clay can be thrown so that it will fall and be cut by the wire. Take up the two pieces, slap them together with force, slap with the palms of the hands two or three times, then throw the lump to the table again across the wire. Repeat as many times as possible. The throwing forces the particles of clay closer together, while the cutting and slapping together cut into any air spaces and eliminate them. Clay shrinks as it is dried and as it is fired. This shrinkage causes cracks where air spaces are prominent. When clay is fired, the air spaces left expand under heat while the clay shrinks. Hence much breakage may occur if large air holes are left in the clay body.

c. *Making the plaster-of-Paris discs.* For building a vase one needs a surface on which to keep the vase until built. It should be small enough to handle easily. Wood warps because of the moisture. A slate will do. The best is a plaster-of-Paris disc, made by pouring plaster-of-Paris into a pie pan about one and one-half inches deep. The pie pan should first be well soaped with liquid soap. To mix the plaster for pouring, put about a quart of water into a bowl. Sift dry plaster-of-Paris through the fingers so it falls into the center of the bowl. Continue until a little dry mound appears above the water. Then stir with a spoon until the plaster begins to pull. Pour immediately. Note how quickly it sets.

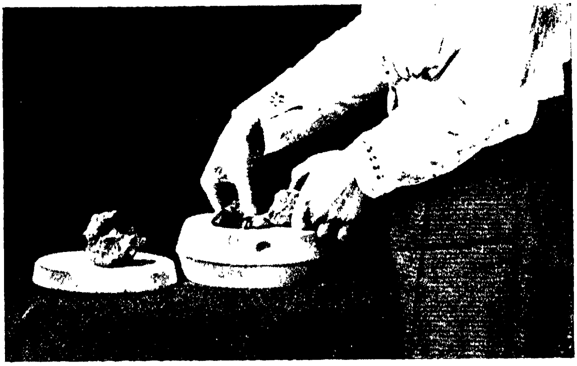


FIG. 146 Making the Base of the Bowl
Note the use of the plaster-of-Paris discs.

d. Making the base of the bowl. Press clay with the thumbs down upon the plaster disc very firmly until you have a level surface about a quarter of an inch thick, larger in any dimension than the base of the bowl. Draw a circle on this surface the size of the base of the bowl. With a pencil point, a knife, or a stick cut away the clay beyond the circle.

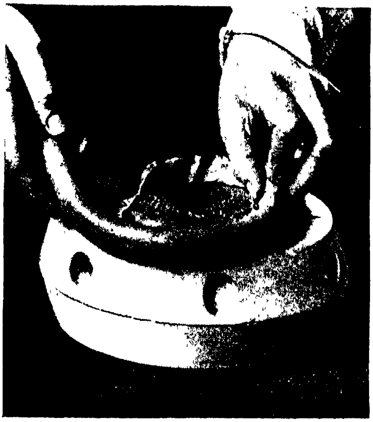


FIG. 147. Applying the First Coil

e. Making a coil. Take a piece of clay a little smaller than the first. Shape it into a cylinder by gently squeezing in the hands. Lay it down upon a smooth surface. With the fingers slightly spread, give it a gentle push away from you, making equal the pressure with all the fingers. When it has ceased rolling, give it a backward touch with all the fingers, causing it to roll toward you. Too much pressure flattens it so that it will not roll. As the fingers touch there should be a slight outward movement toward the ends. Continue rolling, watching for thick and thin places. Always have the fingers touch at the thick places. When the coil is about three-fourths of an inch in diameter, it is ready to apply.

f. Making slip. Mix some clay with water until it is about like moderately thick cream.

g. Applying the coils. With a pencil point make the outer edge of the surface of the base rough, extending the roughness in from the edge about one-half an inch. Put a little slip upon the roughened surface. Take the coil in the right hand, holding near one end. This hand does the work while the other turns the dies and manages the rest of the coil. With the first finger of the right hand, press the coil down upon the base, while the thumb and second fingers press toward each other on the sides of the coil so that the first finger is between them. These two prevent the first finger from mashing the coil flat. Continue pressing until you have carried the coil around the base. Cut it off diagonally. Cut the beginning end so that the two ends fit together diagonally and press them into place. Holding the left hand gently on the outside of the coil, with the right hand rub the coil and base together so that all cracks disappear on the inside. Use the pads of the fingers. Place the left hand inside and rub the outside and base together. The work of the left hand here is very important in holding the coil in place when being rubbed. Apply the template and true up the walls. See that the top is level before applying the next coil. Continue applying coils in the same manner, roughening the surface first. To give an outward curve, place the coil well

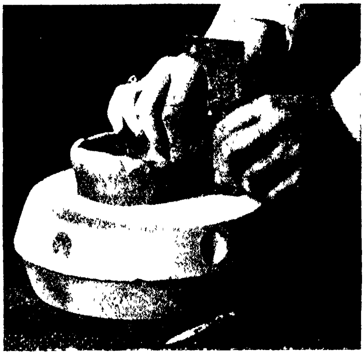


FIG. 148 Using the Template in Shaping the Wall

out; to give an inward bend, place the coil well in on the wall. Smooth the surfaces by pressing with thumb and finger pads upon "bumps," always having fingers inside pressing or holding against those pressing on the outside.

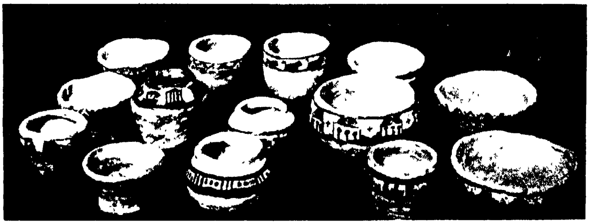


FIG. 149. Bowls Made by a Third Grade

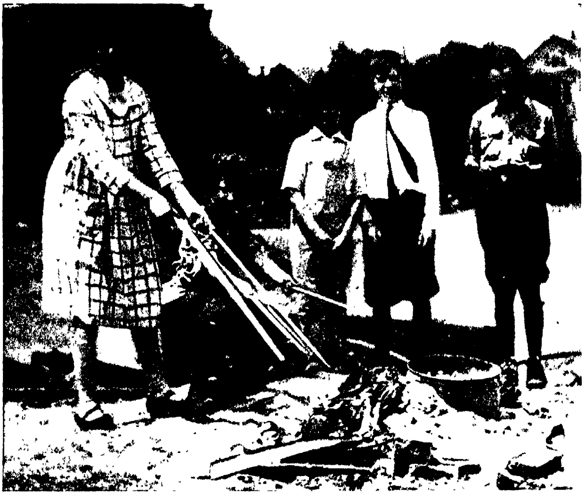


FIG. 150. Fifth Grade Children in Passaic, New Jersey, Firing Pottery Out of Doors

If a coil is poorly placed, all coils above it are affected. If a coil is put on in too soft a condition, it cannot bear the weight of the coils above it and hold its shape. See that each coil is exactly right before adding another, as effort is wasted in building upon poor coils.

Trying the Indian method of firing pottery. Indian pottery from the southwestern states often has smoke on it.

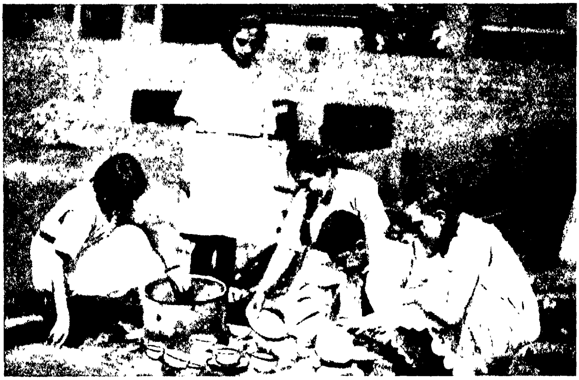
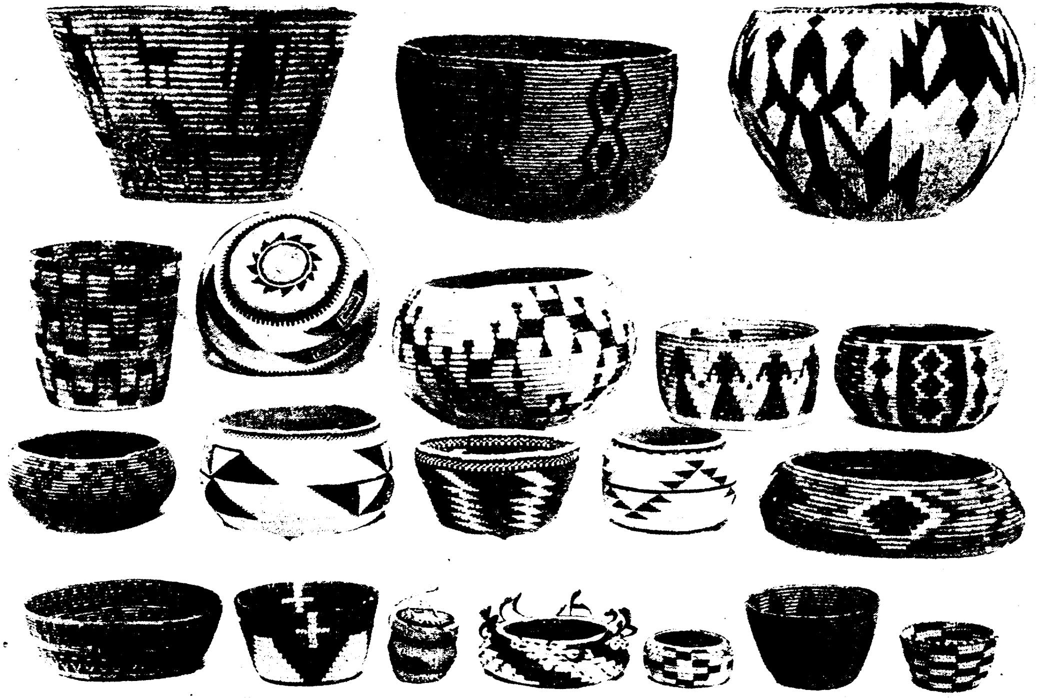


FIG. 151. Passaic Children Removing the Dishes after Firing

This is due to the method of firing. A hole is dug in the ground. A fire is built in this hole and kept going until there is a large bed of hot coals. These are raked out, the pieces of pottery are put in, and the coals are piled over them. Then a fire is built upon the coals and kept burning for a day. This method may be tried by the children. To avoid loss by breakage from the heavy weight of the fire resting on the pottery, the pieces may be put into iron kettles covered with iron lids and the kettles covered with the coals.



Courtesy American Museum of Natural History

FIG. 152. Indian Baskets

It is obvious that no glaze can be used on pottery so fired. Nor do we find Indians using glaze. They put a smooth surface on the pieces, and they often decorated them with mineral colors. Some mineral colors can be bought of B. F. Drakenfeld, 50 Murray Street, New York City, and applied in decorations like the Indian designs.

Finding how Indian baskets were made. Borrow some Indian sewed baskets or study closely such pictures as can be secured to see how firmly they are sewed. They would evidently hold water, especially if coated with a little clay, as they easily might be. Read Snedden's *Docas the Indian Boy*, pages 17–21. Such baskets were made of stems, twigs, roots, bark, or leaves, sewed with grasses or strips of bark or roots. The roots, twigs, or bunches of leaves furnished the foundation around which the grass was wrapped two or more times and then sewed into place with a stitch to the part already made. The grass thread was again wrapped and again sewed. And so the process continued. If it was closely done, the basket could be made very tight.

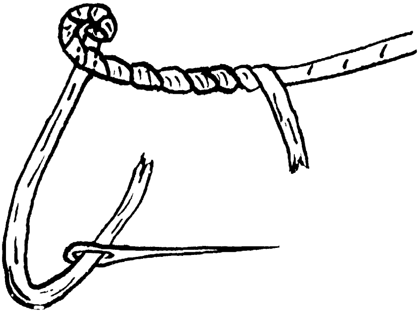


Fig. 153 Coil of Reed Wrapped with Raffia Ready for Sewing

If available, several Indian baskets should be examined to discover the method of sewing them. It is hardly advisable to have children make them by the sewing method as the work is tedious for small fingers. It requires so much repetition of the process with few new ideas involved that there is not much educational value in it relative to the time and effort required. If there are those who wish to try making baskets in this manner, the material should be vegetable, preferably of the environment. Paper or other artificial material should not be used. Pine needles, rushes, and grasses may be available. The most difficult material to secure is a long, tough grass for sewing. Raffia has no rival in most of our environments. No green material should be used, as it shrinks in drying and leaves a loose, unstable basket. All of the material should be soaked in warm water immediately before use.

It is interesting to compare the sewed baskets of the Indians with sewed baskets of other peoples. Note what other peoples make sewed baskets as you learn of their industries.

Noting the connection between sewed baskets and coiled pottery. Think of the Indian method of making a coiled vase, described on page 293, and think how that vase must have looked before the coils were rubbed together. Look at an Indian basket of large coils and note the similarity. Some have wondered if the coil method of making pottery was suggested by the form of baskets. Much dipping of a basket into muddy water could, in time, coat it thoroughly with mud. If this mud happened to be clay, the basket might thus become fully lined with a layer of clay and be discarded by throwing it into the camp fire. Or such a basket might get into the fire by accident. Coming back later, the owner might find that the basket had been burned but that the clay had been hardened by the heat and had retained its form. So men have wondered whether this hardened clay, in coils like the shape of the basket, may have suggested making pottery in this fashion.

Finding things made of clay mentioned in the Old Testament. It will be interesting to find how much the Hebrews used clay. Make a list of all of the clay products mentioned in the Old Testament. Where did they get their clay? Were they potters? Read Jeremiah 18 : 1-10. How did Jeremiah make his pottery? Collect pictures of Hebrew water jars. Read the references which can be found showing the Hebrews using their water jars.

Making a pitcher lamp. From descriptions and illustrations of the Hebrew lamp, try to make one of clay. If it can be glazed and fired, place oil and a wick in it and see what kind of flame one gets. What kind of oil should be used? Does it give much light? If the lamp cannot be fired, put some oil and a wick in a small pitcher or gravy boat and light the wick to see how much light it gives.

Courtesy Metropolitan Museum of Art

FIG. 154 Egyptian Terra Cotta Lamps

Finding what mention the Bible makes of baskets. Read the story of Moses hidden in the bulrushes in Exodus 2. In what was he placed? Of what was it made? What were the bulrushes? See the chapter on Records, page 367, for another use of bulrushes. Among other Bible references to baskets are: Genesis 40 : 16 18; Jeremiah 6:9; 24: 1; and Matthew 14: 20.

Finding how important clay is in the local community. Is there a brickyard, sewer-pipe factory, tile yard, or pottery in the community? How many are there? How many people work in them? Where are the clay banks from which they get their clay? From the freight office find how many carloads of clay products are shipped out a month. If there are no factories near, find what you can about the shipments of brick, tile, sewer pipe, pottery, and dishes into the community from other places. How many stores sell such products? List all of the ways in which the community uses clay products.

If there are factories making clay products in the community, a map of the neighborhood may be made on which should be located the factories and the banks from which they receive their clay. The freight house and the railway connections may be shown. If clay is shipped in, note whence it comes. On a large map find the places from which clay products are shipped to your community. If the industry is important in your community, charts and illustrations of data found may be made.

Finding other materials used for vessels for liquids. For making vessels, some peoples use materials which are unfamiliar to us. In the days of your great-grandmothers, gourds were often grown in the garden to be used in making dippers, especially, and often also in making vessels for other purposes. It will be of interest to get some gourd seeds, plant them in the garden, raise some gourds, and make a dipper. They also make interesting hanging baskets. In some parts of this country they are still found at wells or springs and used for drinking. Why do you think the pioneer used gourds? What disadvantage do you see in them?

The Hebrews and others living in semi-arid countries made water bottles from the skins of animals. Probably the water bottles used in the time of Abraham were of skin. But bottles made of clay were also used very early. Read stories of desert travel and note the importance of water bottles in the desert. What were the advantages and disadvantages of skin water bottles? Read Matthew 9: 17 relative to new wine in old bottles.

Primitive and pioneer peoples sometimes use shells for utensils. What advantages have shells for such usage?

Listing things made of glass. Make a list of all of the things that can be thought of which are made of glass. Is it used as much as clay? What differences are there in use between glass and clay products? Find, in an encyclopedia or other source, of what glass is made. The molten glass is poured or blown into molds to give the desired shapes. Examine several things made of glass to see whether you can find the lines made by the mold. Glass for vessels and ornaments was used among the Babylonians, Egyptians, and other early peoples most progressive in civilization several centuries before the Christian era. The common forms of window glass which we know are of but recent use.

Desirable outcomes in Grade III. From this work the teacher may expect:

1. An appreciation of Indian baskets and pottery.
2. An interest in the designs made by the Indians and an appreciation of their beauty in line, rhythm, and color.
3. Knowledge of the fundamental processes in making pottery by the coil method, and some ability to recognize a coil-built vase.
4. An understanding of how the Indians fired their pottery, and of why their pottery is not waterproof.

5. Some conception of the work of the archæologist.

6. Respect for the Indian of long ago because of his ability as a workman in clay.

7. Some judgment of the value of hand-built vases in terms of the work put upon them.

8. Some knowledge of the utensils used by the early Hebrews.

9 A clearer notion that each people makes the things it needs of the materials available — an idea of adaptation to environment.

10. Some notion of progress as expressed in living conveniences.

11. Some idea of the importance of clay to a community, and of the volume of business in a community.

12. Some understanding of the processes used in making glass.

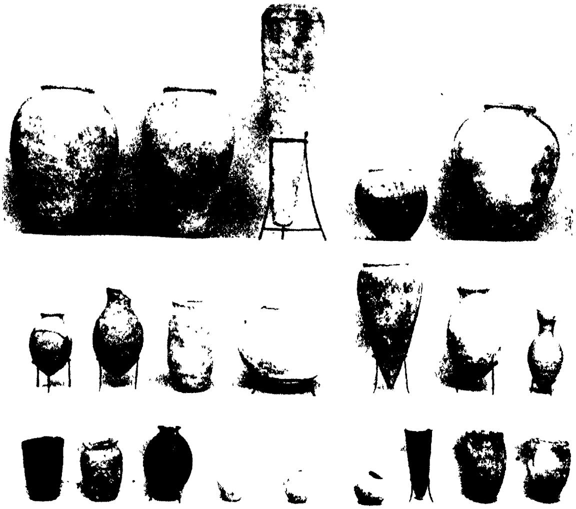
13 Awareness of the variety of materials that have been used in making vessels for water

GRADE IV

Comparing Egyptian, Greek, and Roman pottery. Study the pictures of Egyptian, Greek, and Roman pottery shown in the illustrations on pages 307 to 311. Find other illustrations of the pottery of these peoples. Much resemblance is to be found in the shapes, designs, and colors. The history of the development of pottery in the ancient nations will help to explain these resemblances. A brief summary is here given to guide the teacher's reading.

In his *Pottery Primer*, W. P. Jervis indicates that probably there were three centers of influence in the 'pottery development of the world, namely, China, Egypt, and Peru. We do not yet know how old the Peruvian art is, but it far antedates the Incas. The Peruvian ware bears some resemblance to Greek and Egyptian pottery. Some have thought they might trace a connection with the Mound Builders of the United States.

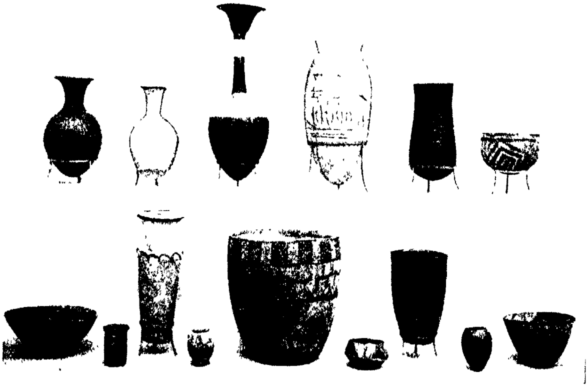
Due to their burial customs, we know much about the pottery developments of the Egyptians and Greeks. What is in existence to-day is ware that has been preserved in the graves of these ancient peoples. The Egyptians and Greeks had available wonderful deposits of clay, and it is believed by some that the art originated in this part of the world. The earliest methods of various nations seem to have been by shaping coils of clay. The Egyptians, Greeks, and Japanese all claim to have invented the potter's wheel. It is not



Courtesy Metropolitan Museum of Art

FIG 155 Egyptian Vases and Vessels, Chiefly of the Predynastic Period

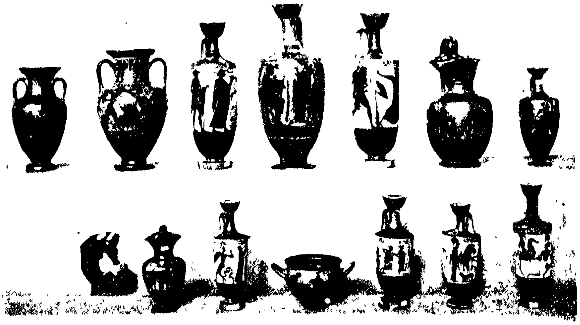
improbable that the same methods may have been independently invented and developed by several early peoples. The Egyptian hieroglyphics of 3000 B.C. have pictures of earthenware vases. A tomb at Beni Hassan has illustrations showing the whole process from wheel turning to carrying the finished ware away from the kiln.



Courtesy Metropolitan Museum of Art

FIG. 156. Egyptian Pottery, Showing Attention to the Decorative Elements

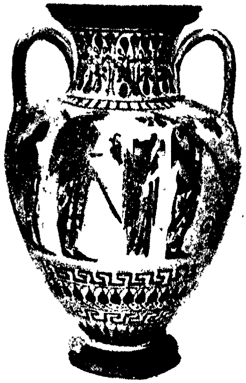
Utility seems characteristic of the early Egyptian ware. Many pieces, as shown in Figures 155 and 156, were rounded at the base for placing in a hole in the ground. Probably these were receptacles for food. The ware was practically all made of red clay, furnished abundantly by the overflow of the Nile. At first there was no decoration. Later bands of color were added for ornament, often covered with a resinous material which preserved the color. These bands were vertical, not horizontal as characterized the Greek and later Egyptian pottery. This earlier Egyptian ware is characterized by poor finish, pointed bases, and extreme smallness of the openings. Shapes were numerous, and sizes ranged from a few inches in height to three or four feet. Later, the vases were given a high polish, sometimes by mechanical means, sometimes by giving a coat of lime, and later by glazing. The characteristic colors seem to have been red, black, white, and brown. About 1900 B.C., blue glaze was used, and at about 900 B.C. a green glaze was developed. After the conquest of Egypt by Alexander, its pottery reflected the influence of foreigners. Two agencies were therefore operative in producing a resemblance between Egyptian and Grecian wares — the influence of foreign invasion, and that of commerce as carried on by the Phœnicians. The latter tended to carry Egyptian ideas to Greece and other countries.



Courtesy Metropolitan Museum of Art

FIG. 157 Black-Figured Greek Vases of Attic Make, 550–475 B.C.
Most are of the lekythos type

Because of the custom of burying vases with the dead, there are many Greek vases extant to-day. Burch estimated that there were fifteen thousand in museums in 1873. Recent activities in archæology have much increased this number. The first or earlier vases were unglazed. The largest of these was a cask, called a *pithos*. It is related that it was in one of these that Diogenes lived. Another interesting type was the *amphora*, a two-handled vase, often undecorated. The red clay vases were decorated with black. The meander, or key pattern, early characterizes the Greek ware. Geometric patterns prevailed rather than any pictorial treatment in the vases prior to the seventh century B.C. Then came animal and bird figures, sometimes placed between band and friezes, with the decoration still in black. Human figures in profile with eyes drawn as for front view followed. Soon came the change from black figures on red to red figures on black, together with much fineness of drawing and design. It is to the study of these designs that we owe much of our knowledge of the mythology, life, and glory of the Greeks. Other forms commonly made were the *stamnos*, the *kalyx*, the *hydra*, and the *lekythos*. Greek pottery as an art began declining about 250 B.C. and seems to have disappeared by 300 or 400 A.D.



Courtesy Metropolitan Museum of Art

FIG. 158 A Black-Figured Amphora Vase from Greece, 550–500 B.C.

As with all other nations producing pottery, the Roman product passed through early stages of inferior quality. One prominent use made of clay was the making of tiles for decorating their houses. They followed the Greeks in their making wares of black, glazed surface. Their outstanding work is the red Samian ware, made of a brilliant red clay, covered with a thin glaze which chemists have not been able to analyze. There is uncertainty as to the nature of the red body or the source of the material, no such clay having yet been found. These red Samian vases have been found wherever the conquering Romans went. One marked use of clay which characterizes the Romans is the great number and variety of lamps — lamps low, long, oval, elongated, circular, and lamps with handles and with spouts for the wicks. Note illustrations in Fig. 154. They were made in molds which were made in several pieces. See the discussion of mold making in Grade V. The red Samian vases, too, were often made in molds. The Metropolitan Museum in New York City has quite a collection of molds for these vases. It does not appear that plaster-of-Paris was known, however.

Courtesy Metropolitan Museum of Art

Fig. 159 An Athenian Krater, 460 B.C.

Another development of interest to potters is the use of oxide of tin in making glazes opaque. This process was known to the ancients, but they do not seem to have done anything with it. The Arabs seem to have originated it, but it was in Spain and Italy that it was developed. Jervis classifies earthenware as *opaque* and *not vitrified*, and divides it into groups: the *faience*, which is opaque because it is covered with tin enamel; and *majolica*, which is like faience with the addition of gold, silver, and copper lusters.

This use of tin in making enamels is a part of a movement which connects European pottery with that of Persia and

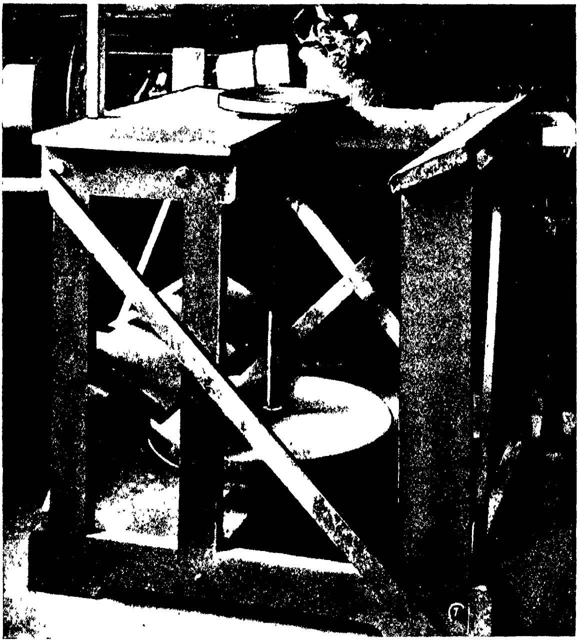


FIG. 160 *a* A Potter's Wheel

The lower wheel is weighted as can be seen. This aids in maintaining the momentum obtained in kicking. Contrast with the method of propelling in the wheel in Fig. 160 *b*

Africa, for the Arabs, and later the Moors who conquered Spain, brought with them a knowledge of pottery methods used by Saracenic potters of Bagdad and Cairo. The Spaniards had some knowledge which they had acquired from their Roman conquerors. The plentiful supply of tin in Spain offered opportunity to develop enamel glazes and lusters, thus bringing the Hispano-Moresque potteries into prominence.

In shipping the product from Spain to Italy, the island of Majorca came to be a port from which came vessels to Italy. It is thought that in this way the Hispano-Moresque pottery came to be known as majolica because it came on Majorcan vessels.

With the incoming of the Italian Renaissance, pottery came under the patronage of the reigning princes. Some of the greatest artists of that time made pottery. Among these was Raphael. A number of pottery centers sprang up. One of these was Faenza, and it is thought that the name, faience, came from this town.

Finding how vases are made on a potter's wheel. In reading accounts of early pottery, one finds frequent references to the potter's wheel. Many nations claim to have invented it. There are various types of the wheel, and pictures of several should be secured. The essential element is a flat disc with a shaft fastened to the center on one side. The other end of the shaft may be placed in a hole so that it can be whirled. The people of some Asiatic countries make such a wheel. The shaft is placed in a hole in the hard, dirt floor. The workman sits on the floor, legs astride, and whirls the disc with his hand as he works.

By some, a treadle device has been made for whirling the disc. Note the treadle in Fig. 160 *b*. An arrangement for turning the wheel has been made by some upper grade school boys by using the parts of an old sewing machine or of a bicycle. One kind of wheel liked by some potters is the *kick wheel*. See Fig 160 *a*. Two wheels are needed for this. The upper one is the disc, about ten inches in diameter, for the actual work. The shaft connects it with a lower wheel, much larger, weighted on the outer rim to keep it whirling longer. The workman has a seat on one side of the frame in which this double wheel is suspended. He kicks the lower wheel until it is going rapidly. Then he rests his feet on either side of the wheel on supports provided, while he works on the clay on the upper disc until the wheel runs down. Then he rests his hands while he kicks. And so he proceeds. In recent years, many potters have connected their wheels with a motor and have thus secured a continuous whirling; hence wheels like those in Fig. 160*a* and Fig. 160*b* are not much used now.

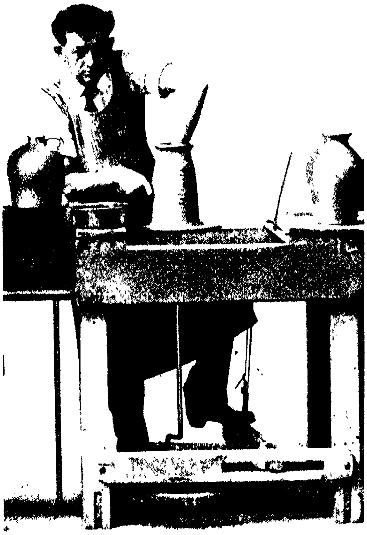


Fig. 160*b* A Potter's Wheel

A form in common use for making jugs and crocks until displaced by electrically-driven wheels.

In working on a treadle wheel, like the one in Fig. 160*b* the foot continues kicking the treadle back and forth all the time the potter works, while he stands on the other foot. This tends to make the position while working less steady than it is when using some other kinds of wheels.

THE POTTER[1]

The potter stood at his daily work,
  One patient foot on the ground,
The other with never slackening speed,
  Turning his swift wheel round

Silent we stood beside him there,
  Watching the restless knee,
Till my friend said low, in a pitying voice,
  "How tired his foot must be!"

The potter never paused in his work,
  Shaping the wondrous thing;
'Twas only a common flower pot,
  But perfect in fashioning.

Slowly he raised his patient eyes,
  With homely truth inspired,
"No, Marm; it isn't the foot that works;
  The one that *stands* gets tired."

ANONYMOUS.

If possible, visit a potter and see him at work at his wheel. The procedure in making a vase should be seen to be appreciated. The ball of clay is thrown as near the center of the disc as possible while the disc is whirling. Then the potter puts his two hands around it and tries to center it by pressing as it whirls until the ball is round and exactly in the center. To make the work easier, he wets his hands every few minutes in *slip*, a creamy mixture of clay and water. When the ball is well centered the thumbs are pressed down in the middle to open it out. Pressure is then applied on the inside and outside at the same time. By directing this pressure, he makes the walls rise as they are pressed thin, and the

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[1] From "Tommy's First Speaker," by permission of M A. Donohue & Co, Chicago.

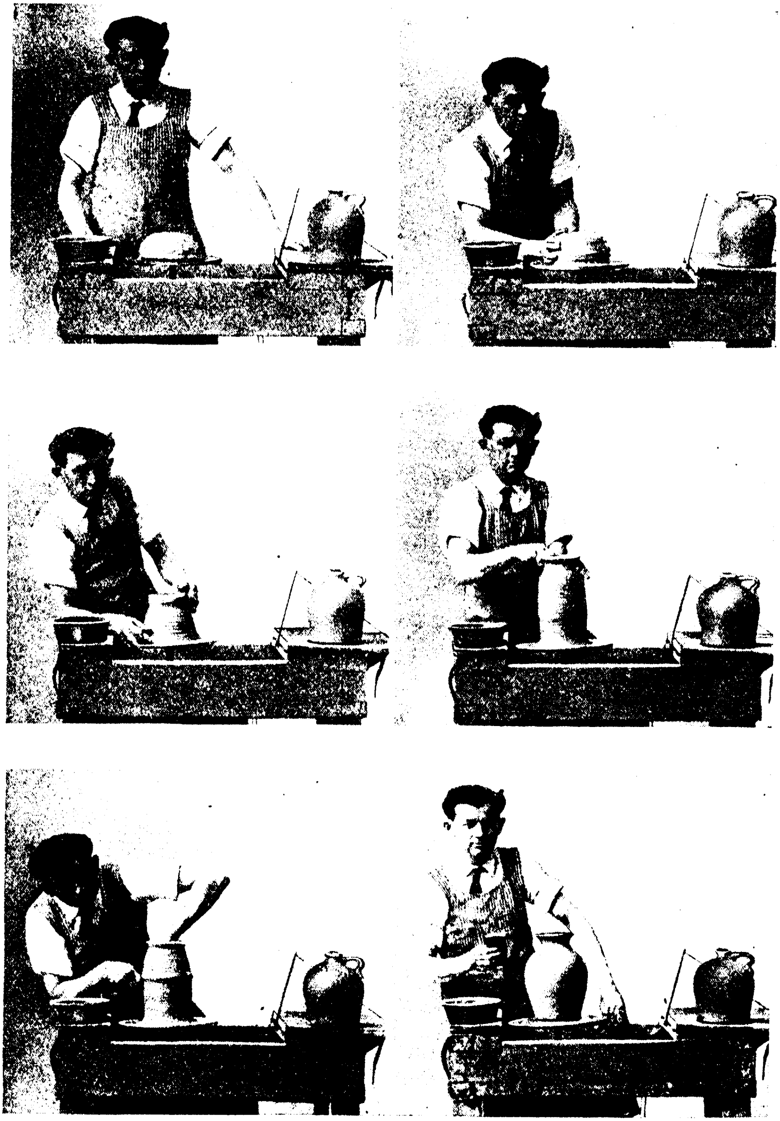


FIG. 161. Making a Vase

desired shape is obtained. Sometimes a *rib* is used by the potter in shaping a vase or jug. It is usually a thin piece of hardwood. Note the one in the hand of the potter in the last picture in Fig. 161. Wheel pieces may generally be recognized by the lines running around on the outside and inside of a vase due to finger pressure.

Until a few years ago, the wheel work in pottery making was done on wheels quite similar to those shown in Fig. 161. With the availability of electricity, this has changed. What advantages can you see in the electrically driven wheel? The result in factories has been a tendency toward standardized work and toward discouraging creative work.

Tracing the development of pottery in various nations. Review what has been given regarding the pottery of Egypt, Greece, and Rome on foregoing pages. Collect samples of pottery from as many different nations as possible found in your community. Supplement these with pictures, descriptive material, and stories of the various kinds of pottery. The following summary of the development of pottery in various nations and epochs is given as an aid in guiding the teacher in gathering data.

Of the pottery of China, much can be found of interest. The Chinese are regarded as the original makers of true porcelain. By porcelain is meant a material which is hard, white, and translucent. The body and glaze are of the same substance. When broken, it is found to be vitrified. Hard porcelain is possible only when made by high temperatures and when China clay is available. When the Chinese began making porcelain is a matter of uncertainty. Some place the date at 618–907 A.D., during the Thang dynasty; others as late as the Ming dynasty, 1363–1643; while some Chinese say it was made in the Han dynasty, B.C. 206–A.D. 25. Glazes were probably introduced at about 200 B.C. The Chinese were makers of pottery as early as 2690 B.C., so their legends say. This early pottery is known as earthen or stoneware. It is, however, the Chinese porcelain which has modified and influenced European pottery methods. This influence came when the Dutch East India Company began extensive importation of Chinese and Japanese ware, a movement which caused the town of Delft to become a pottery center, largely engaged in adapting Chinese ideas. This copying of Chinese ware explains the preponderance of blue ware, a blue decoration on white enamel, in the Delft pottery.

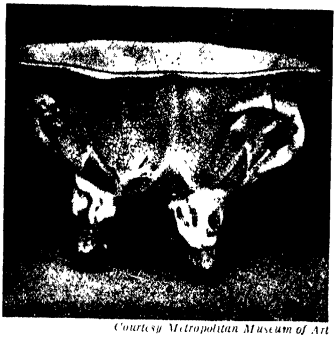

Courtesy Metropolitan Museum of Art

FIG. 162 A Chinese Crackleware Bowl of the Yung Cheng Period, 1723–1735

One early Chinese development not so generally copied was the *crackle-ware*. This particular crackled pattern under the glaze was accomplished by means of a unique mastery of the heat in firing the pottery. A sudden cooling at a certain stage caused the crackles, while further firing perfected the glaze over the crackles.

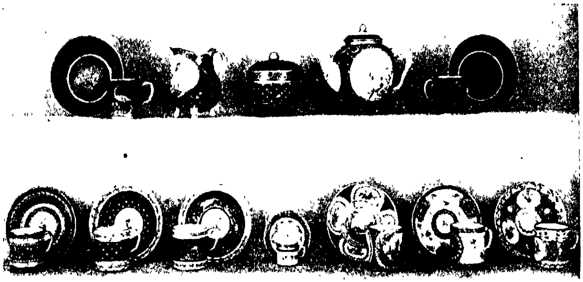
There is a single reference indicating that the Japanese may have known how to work in clay as early as 600 B.C. Aside from this, the earliest accounts begin with the coming of Korean potters at about 27 B.C. The Japanese borrowed from the Chinese and modified what they got through the wonders of technical skill which they developed. They delighted in elaborate tricks, resulting in pierced ware and in their "grains of rice" ware. The latter was made by piercing the pottery with very small holes and then inserting in each hole a drop of translucent glaze. Some authors credit the Chinese with devising such ware. The Japanese further made use of a great variety of color. They themselves attribute some of their ability in pottery to the fact that Korean potters settled in Japan, bringing with them knowledge probably derived from China. A group of these Korean potters formed a colony at Satsuma in the sixteenth century, and later this town became the center of the famous Satsuma ware.

Tea was introduced into Japan in the thirteenth century, and the tea ceremony in which the bowl and water jar were handed round to the guests for inspection gave impetus to excellence of workmanship in making the dishes used. The Japanese love of nature and their persistence in using every color they could devise led to great variety in their ware.

Another Chinese development under the Ming dynasty was the use of tints of rose or of green glaze over the glaze pattern previously fired at a higher temperature. The rose color in almost every conceivable tone was made from gold, the secret of which has since been very difficult for potters to discover.

With the importation of Chinese porcelain into Europe, there developed an earnest effort on the part of European potters to make such ware. The French first solved the problem by making what are classed as *soft porcelains.* The process included making a composition of such materials as sand, salt, soda, alum, and gypsum. This was made into a thick slab or loaf and burned. The resultant was ground, or fritted, and made into a mixture with the addition of materials to make it plastic and then shaped. In a similar way glazes were mixed, baked, fritted, and made into a liquid suitable for applying. The resultant was a soft porcelain of great beauty. This process was perfected at St. Cloud in 1695, and later carried to Sèvres, the successor of the St. Cloud potteries. These two were owned in part by the king In 1795, Louis XV bought the entire works at Sèvres.

In 1709 the Germans discovered kaolin in Saxony. Washed koalin is China clay, the material needed for making hard porcelain. This made possible the manufacture of ware such as the Chinese and Japanese were making. This discovery came just fourteen years after the French invented the fritted ware as a way of making porcelains. With the increased interest in the manufacture of porcelains, the Saxons withheld their kaolins from the French potters, but in 1765 Madame Darnet, wife of a poor surgeon, made a fortunate discovery. She found in a ravine near Limoges a white earth which she thought would be a good substitute for soap. Analysis, however, revealed that it was kaolin, the clay so much needed for the manufacture of hard porcelains. As a result, by 1804 the Sèvres potteries stopped making the soft porcelains. In time Limoges came to be the center of the French pottery industries, partly through the efforts of an



Courtesy Metropolitan Museum of Art

FIG. 163 Sèvres Porcelain of the Eighteenth Century

American, David Haviland, who established the Haviland potteries there, beginning in 1839.

An interesting chapter in the story of French pottery is the work of Bernard Palissy. He was born in 1510, before the invention of fritted ware, the discovery of China clay, or the era of importation of Chinese procelains. He was trained as a glass painter. One day he was shown a cup of enameled earthenware and became possessed of an intense desire to make such a thing. He had no notion of how to proceed. He consequently failed again and again, wasting both time and material. It is related that, being a Huguenot, he was persecuted because of his religion; and being considered a pottery fanatic, he was persecuted by his wife and neighbors. The poverty brought on by his persistence in the face of failure led to his burning as fuel for his kiln everything he could find, even to the furniture in his house, before success came. He used nature models, making molds into which to press his clay. So we find some of his ware characterized by serpents, leaves, fish, and fruits. But his glazes were rich in color and beautiful in quality. He stands as a pioneer in building up the great success of France in pottery production.

Authorities credit the English potters with being the most influential modern potters, although English pottery remained without value or outstanding characteristics until the seventeenth century. The ancient Britons were makers of a crude pottery, but there is no evidence of the use of the wheel, of a glaze, or of properly constructed kilns until the Roman invasion. However, the use of wood and horn vessels for food and drink continued for several centuries among most of the Anglo-Saxons.

In the fourteenth century, the monastic orders began making tiles of two colors, beautiful in design. John Dwight, in 1671, established a factory for stoneware and became the first English potter of note. He introduced the use of salt glazes, a German discovery. Another impetus came to pottery at about this time in the interest in *Delft* ware which developed from the importation of Chinese ware.

Staffordshire has been a center of the pottery industry for a time longer than can be traced. It has excellent clay deposits. The work there was mediocre until the salt-glazed stoneware became famous, due to the efforts of two Dutch brothers named [illegible]er who came to England with William, Prince of Orange, in 1688. Following this impetus, came the efforts of Josiah Wedgwood, who raised the work of the potter to an art. His contributions include the development of his jasper wares, first made in 1776, and the making of cameos and intaglios, as well as introducing system into the conduct of the factories he built up. At this time the process of transferring patterns, mentioned on page 355, was devised, and Wedgwood put it into use. He did much to raise the making of English pottery to a leading position. He died in 1795.

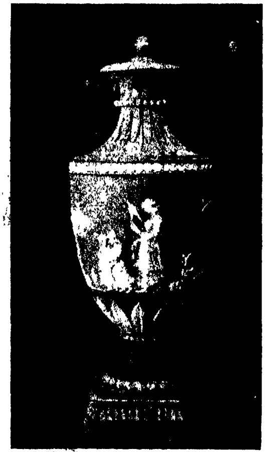
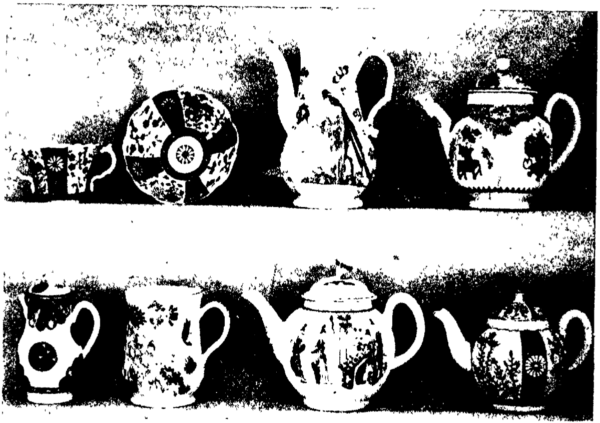

Courtesy Metropolitan Museum of Art

FIG. 164. A Wedgwood Vase

Similarly, it is interesting to trace the story of Chelsea, Bow, Worcester, and other wares of the English; the influence of the discovery of the effect of burned bone upon the degree of heat possible in firing; the work of Enoch Wood; the making of luster wares; and the spread of porcelain manufacture in England, at first through the use of an artificial process similar to that of the French, and later through the use of kaolin after its discovery in Cornwall in 1755.

Finding what different kinds of pottery are on sale in the stores. Committees of pupils may be appointed to visit the several stores to find out the various kinds of pottery on sale. From these reports, make a list of the nations whose pottery is on sale.



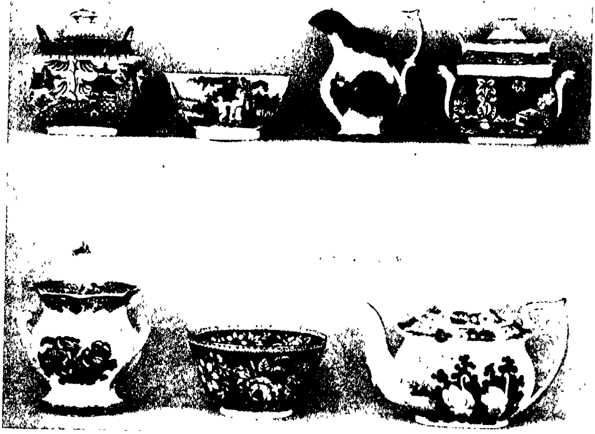
Courtesy Metropolitan Museum of Art

FIG. 165. Worcester Bow Pottery of the Eighteenth Century

Finding how many kinds of pottery are in the homes. It will be interesting to know how representative of the potteries of the world is the list of pottery to be found in the homes. Make such a list as complete as community co-operation will permit. Check this list and that of the pottery found in the stores with the nations studied for their pottery.

Making a pottery map of the world. On an outline map of the world, locate all of the places famous for their potteries.

Using the World Almanac or a similar source of information, locate, by one symbol, all of the nations reported as having clay industries. By another symbol, indicate all places whose pottery is on sale in the town. By still another symbol, indicate all places represented in the homes by the pottery of these places. If the local community has potteries, connect by lines radiating from them those places to which the local pottery has shipped products within the last year as determined by reports of the pottery or the local freight office. Study the resulting map and decide how much the local community is connected with the world through clay products.

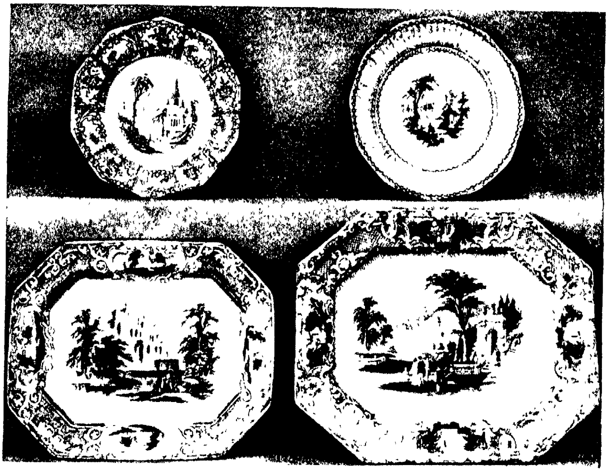


Courtesy Metropolitan Museum of Art

FIG. 166 English Blue-printed Ware of the Eighteenth-Nineteenth Centuries

Reading Longfellow's "Kéramos." Read the poem, "Kéramos," by Longfellow. Follow him in imagination as he journeys over the world to the various potteries. Recall what interesting facts you can about each country as you come to it. Read the potter's song entire. Does it express the rhythm of the wheel?

Making plates. In the factories, plates are made upon plate molds. Such a mold can easily be made. Mix plaster-of-Paris according to the directions given on page 295. Pour this mixture into plates that have been soaped with liquid soap. This gives molds shaped on the outside like the inside of the plates.



Courtesy Metropolitan Museum of Art

Fig. 167. English Plates and Platters of the Nineteenth Century

To make the plate, roll some clay to one-eighth or one-quarter of an inch in thickness. An easy way to do this exactly is to nail two narrow strips of wood upon a board near its edges. These strips should be as thick as the desired thickness of the clay. Use a rolling pin. Roll the clay smooth to the level of these strips. Press this layer of clay down upon the plaster mold and trim the edges to fit. Round them off smooth with the fingers. Draw a light circle on the clay at the place where the rim, upon which the plate rests, should be placed. Make a very thin strip of clay for this rim. Roughen the plate where the circle was drawn. Apply slip. Then press the strip of clay into place, smoothing it with the fingers. Allow the plate to become firm before removing it from the mold.

Courtesy Metropolitan Museum of Art

FIG. 168. Staffordshire Luster Ware of the Early Nineteenth Century

This plate may be painted with an underglaze decoration and glazed with a transparent glaze.

Preparing clay for use. Get some clay as it comes from

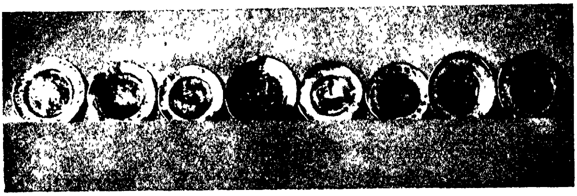


FIG. 169 Plates Made by a Fifth Grade

the ground. Soak it in enough water to make it into liquid form, or *slush*, as it is sometimes called. Strain it through a sieve to remove sticks, stones, and trash. Allow it to stand until the clay settles and the water over it is clear. Drain this water off. Dry the clay on plaster slabs. Wedge according to directions given on page 294.

Making plaster-of-Paris slabs. Plaster-of-Paris slabs are very useful for drying clay because dry plaster-of-Paris has a great affinity for water. Mix the plaster according to directions on page 295. Use bread pans about two inches deep. Brush the inside surfaces with soft soap. Pour the plaster into these pans, full to the top. After the plaster has hardened, remove from the pans. When thoroughly dry, the slabs can be used in drying the clay. When the water in the clay is absorbed enough to make the clay plastic and easily handled, remove the clay and put it into an air-tight container such as a zinc closet, a stone jar with a close-fitting lid, or a galvanized can with a lid.

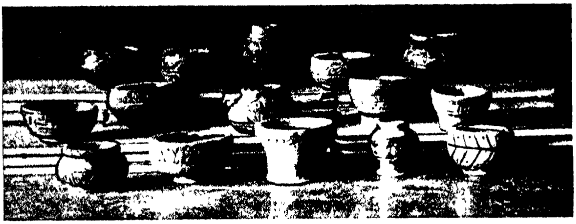


FIG. 170 Pottery Made by a Fourth Grade
Notice the incised designs.

In a factory, after the clay is strained and the water drawn off, it is put into a press where it is squeezed in folds of canvas. From the press it goes to a pug mill which thoroughly mixes and grinds the clay ready for use. These processes take the place of the wedging used in hand work, described on page 294.

Summarizing the processes involved in making a wheel piece of pottery. The entire list of processes involved in producing a piece of pottery, using the wheel method, includes mining the clay, shipping it to the pottery, slushing, straining, pressing, pugging, throwing or turning, drying, glazing, drying, stacking in the kiln, firing, cooling, sorting, and shipping to the stores.

Reading van Dyke's "A Handful of Clay." After the children have become familiar with the sequence of processes, they will be interested in reading the story, "A Handful of Clay," to be found in Henry van Dyke's *A Blue Flower.*

Making a reed basket. List all of the things made of reed which the children can enumerate. Examine them to see if there can be found some outstanding characteristic ways of constructing things of reed. Note the essential — a definite method of interlocking the reeds. Reed baskets lend themselves to experimentation in understanding the process. Reed numbers vary with dealers. For children of this age, two sizes of reed may well be used in making a basket — one, three thirty-seconds of an inch in diameter, the other an eighth or three-sixteenths of an inch in diameter. Soak the reed in hot water before using. Cut eight pieces

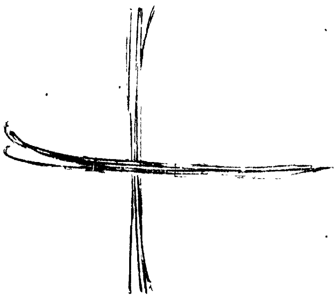


FIG. 171. The Reeds in Place Ready for the Weavers

of the larger reed twelve or more inches long according to the size of basket to be made. With a knife, split four of these a distance of two inches in the middle of each. Slip the four unsplit reeds through the four split reeds. This will form a cross with four reeds extending in four directions. Taking the smaller reed, double it carefully at its middle point, being careful not to break it. Slip this loop over one set of four reeds. Take the upper thread of this loop as a weaver and draw it under the second set of four reeds, over the third set, and under the fourth set, holding it when it has arrived at the loop hooked over the first set. Take the lower half of the loop as a weaver, draw it over the second set of four, under the third set, and over the fourth set. Repeat the process, using the first weaver, and then the second. When going around the third time, carry the weaver over half of a set and under the other half, thus dividing the four sets into eight groups of two each. Go around twice with each weaver and then divide again.

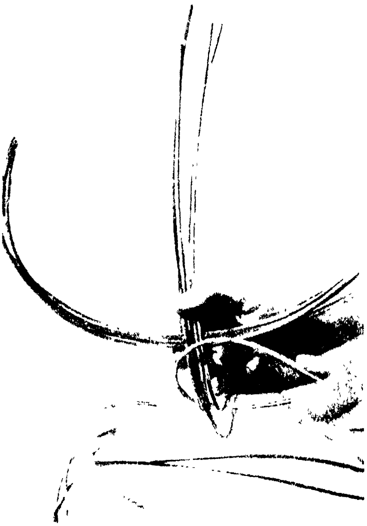


FIG 172 Slipping the Double Weaver over Four Spokes to Begin Weaving

Before weaving, when a division is to be made, bend the reed spokes apart. Letting the first weaver be the leader and the second the follower, continue the weaving as the size of the basket requires, substituting new weavers as coarse as the spokes when the spokes have been spread. To go from the bottom to the sides, bend all of the spokes up and bring the weaving to place by bending the weavers around the spokes, not by pulling on the weavers. In all of this, the weaver must be bent around the spokes, and be placed just where wanted. Do not bend the spokes except when separating them or in turning up the sides — never in weaving.

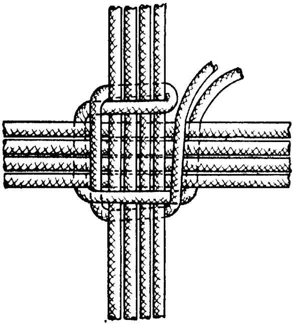


FIG 173. Each Weaver Carried around Once

To finish, cut the spokes of uniform length; bend them over and slip them down into the weaving sheds beside adjacent spokes. Or, if they are longer, each may pass its neighbor spoke and be bent down by the next spoke. As the reeds dry, they will remain firmly set as placed.

The patterns in such baskets may be varied by the use of dyed reeds woven in interesting forms of alternation with the uncolored reeds. Colored reeds may be purchased, or the new reeds may be dyed in school if it is preferred. Indian baskets are often made attractive by the use of varieties of color well arranged. Several shades of red, green, yellow, and brown are available from firms which handle basket materials in quantity. In most cases it will probably be better to buy the reeds colored than to dye fresh reeds in school.

This form of construction is essentially the same as that found in clothes baskets, wicker baby carriages, lamp shades, and other products of reeds, splints, or coarse fibers.

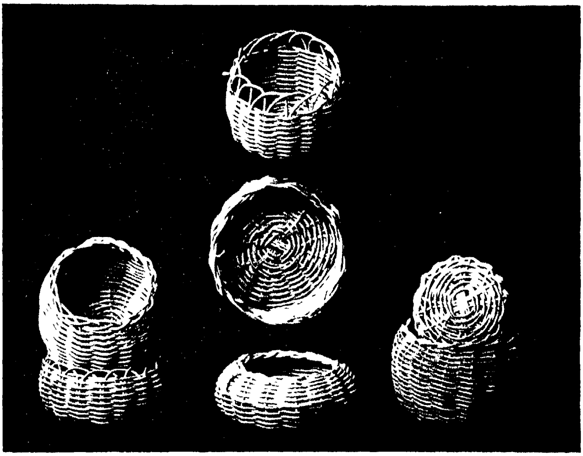


FIG. 174 Woven Reed Baskets

Desirable outcomes in Grade IV. From this work the teacher may expect:

1. A rather definite knowledge of the leading pottery nations of the world and some of the characteristics of each.
2. A rather clear idea of the wheel method of building ware and the prevalence of wheel methods among the various nations.
3. Ability to recognize wheel ware.

4. An appreciation of the coincidence of clay industries in their more advanced form with civilization.

5. A growing interest in the pottery of various nations.

6. An appreciation of the relationship of the local community with the outside world through the clay industries.

7. An understanding of the significance of plaster-of-Paris to the clay industries.

8. A rather clear notion of the sequence of processes in making a vase, from the mining of the clay through to the finished product.

9. An appreciation of some of the literature related to the pottery industry.

10. An interest in the dishes and other pottery products used in the home.

11. Some judgment of the worth of reed baskets and furniture.

GRADE V

Learning how to make a one-piece mold. Choose a bowl or vase the profile of which makes less than a half circle. It must also have no undercuts.

Place it upside down on the floor of a box having collapsible sides. The box should be large enough to leave an inch and a half of space between the vase and each side of the box. It should also be an inch and a half deeper than the vase. Brush liquid soap on the vase and over the floor and inside walls of the box. Mix plaster-of-Paris according to directions given on page 295, and pour into the box so that it covers the vase to a depth of one and one-half inches. When it is set, but before it is very hard, remove from the box and smooth any roughened edges.

Making a two-piece mold. To make a mold of a vase whose shape will not let it come out of the one-piece mold after it is hard, it must be made of more than one piece.

Choose such a vase or bowl. Draw a chalk line across the bottom through the center and continue the line up two opposite sides to the top. This should divide the vase into two equal parts. Make a clay cradle in the bottom of a collapsible box. Bury half the vase in the cradle, using the chalk mark as a guide, having first plugged up the mouth with clay, making the surface of the plug smooth and level with the top of the vase. Make the surface of the cradle around the vase smooth. Soap all surfaces and pour the plaster-of-Paris. When set, remove and smooth. Before the plaster is very hard, with the point of a tablespoon make three round holes about one-fourth of an inch deep in the surface of the plaster where it met the smooth surface of the cradle. These holes are to provide keys for locking together this half and the other, when made, so that they will exactly fit.

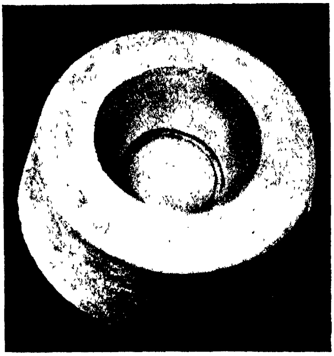


FIG 175 A One-piece Mold

Fit boards or linoleum around the plaster mold just made with the vase fitted into place so that the mold becomes the bottom and the boards or linoleum the walls of a box. Soap and pour. When set, remove and smooth any rough places.' It will be seen that the three holes made by the spoon are matched by three projecting points. Fitting the mold together so that these points and holes coincide, brings the two halves together in proper position for use.

Making a three-piece mold. To make a three-piece mold, divide the vase into halves as before. Put a plug in the mouth and bury in the cradle as before. At the bottom of the base build up a wall of clay extending upright at right angles to the surface of the cradle and continuing the plane of the bottom of the vase so that the plaster-of-Paris will be

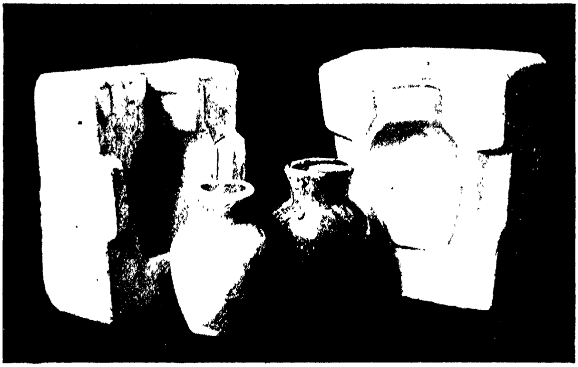


FIG. 176. A Two-piece Mold and a Glazed and Unglazed Piece Made in It

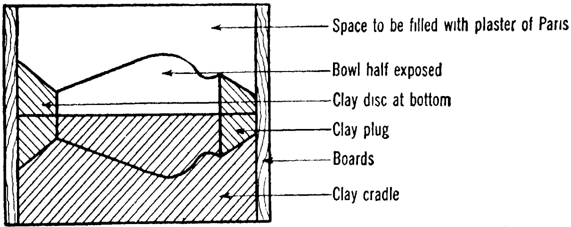


FIG. 177. The Vase Lying in the Clay Cradle
The first stage in making a three-piece mold

confined on the vase side of the plane. Soap and pour. Make two or three key holes. This makes the first piece of the mold. Remove the walls and cradle to the plane of clay at the bottom of the vase. Put walls around the plaster mold just made as a base, retaining the vase in position and the plane of clay at the base of the mold. Soap and pour This is the second piece of the mold. Cut key holes in the edges of the two pieces just made on the surfaces which fitted against the clay base.

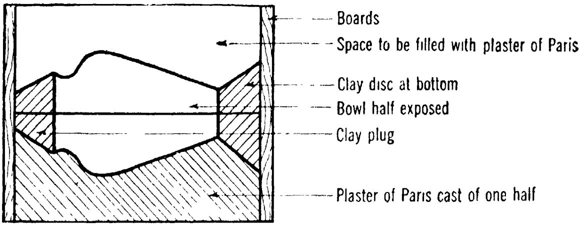

Boards
Space to be filled with plaster of Paris
Clay disc at bottom
Bowl half exposed
Clay plug
Plaster of Paris cast of one half

FIG. 178. Ready to Pour the Second Piece of the Mold

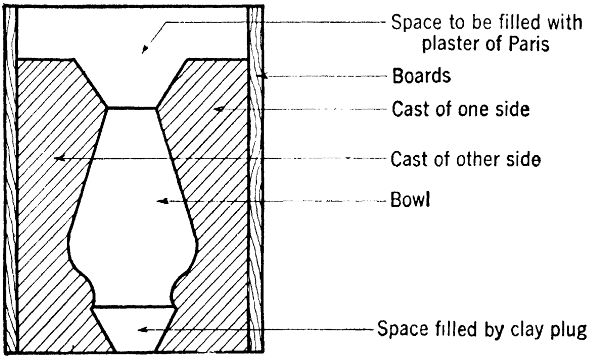

Space to be filled with plaster of Paris
Boards
Cast of one side
Cast of other side
Bowl
Space filled by clay plug

FIG. 179. Ready to Pour the Bottom of the Mold, the Third Piece

Fit around the vase the two pieces made. Place them and the base upside down. Build walls around. Soap and pour plaster-of-Paris for the bottom of the mold. This is the third piece.

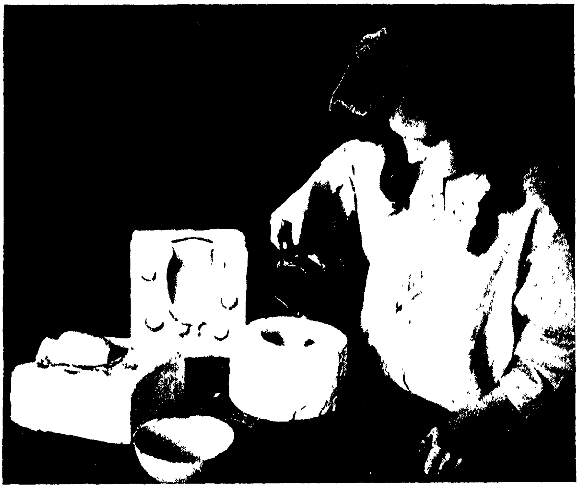


FIG. 180 Using a Mold

The two-piece mold has been taken apart but the vase is not yet removed See the dried slip where the two pieces have been joined. The one-piece mold is just ready for pouring.

Using a mold in making a vase. Be sure the mold is dry. To use a mold of more than one piece, rub slip along the edges that are to be fitted together. Fit and tie securely. The slip fills the cracks so that the liquid will not run out. Make a quantity of slip — quite a little more than enough to fill the mold. The slip is made by mixing clay with water. Strain it to remove lumps. Pour the mold level full of slip. The dry plaster-of-Paris absorbs the moisture and leaves the clay deposited upon the inner walls of the mold. If the mold is not kept full, more clay will be deposited in the lower part than near the top, and the vase being made will have walls of uneven thickness. Watch the top edge of the wall of the vase being formed. When it is of the desired thickness, the absorption process should be stopped. Make allowance for the fact that the walls will shrink somewhat in drying. To stop the absorption, lift the mold very carefully and pour out the remaining slip. Allow the mold to stand until the vase has become " leather hard " and has shrunk from the mold. Carefully remove the parts of the mold from the vase. A ridge will be found where the two pieces of mold met. This can be removed with a sharp knife. Be careful to protect the wall and support it by holding one hand inside when working to remove this ridge. The balls of the fingers should be used to smooth this ridge finally.

Learning to recognize the different kinds of pottery. Pieces of pottery made by the coil method are to be recognized by the finger marks and the " ribbed " sensation one gets as he rubs his fingers up and down the vase, both on the inside and outside.

Wheel pieces are to be recognized by the lines and ridges running around and around. Note this effect especially in some Chinese and Japanese vases. Mold pieces, on their outside, may show ridges of wheel pieces or finger marks of coil-built pieces, for such pieces often are used in making the molds. These usually will not be noticed on the inside. Mold pieces are to be characterized by the lines or ridges made at the junction of the pieces of the mold. Examine a number of pieces and decide how they were made.

Gathering materials about American pottery. B. F. Drakenfeld, 50 Murray Street, New York City, publishes a booklet entitled *A Pottery Primer*, by W. P. Jervis. It contains a very concise account of the different American potteries. Magazines sometimes contain advertisements of these potteries. The Readers' Guide will give references to magazine articles about some of them. Among the prominent potteries are: The Dedham Pottery, Dedham, Massachusetts; Hampshire, Keene, New Hampshire; Markham, Edwin Markham, Ann Arbor, Michigan; Newcombe, Sophie Newcombe Memorial College, New Orleans, Louisiana; Rookwood, Cincinnati, Ohio; Teco, Gates Potteries, Terra Cotta, Illinois; Trenton Potteries, Trenton, New Jersey; Marblehead Pottery, Marblehead, Massachusetts; Zanesville Potteries, Zanesville, Ohio; Grueby Faience Company, Boston, Massachusetts; the Robineau Pottery, Syracuse, New York; the Onondaga Pottery Company, Syracuse, New York.

Letters can be written to some of these or others the addresses of which may be known or found, and some excellent material may thus be obtained which will give some idea of the pottery industry in this country.

Gathering data relative to the various clay industries. From books, newspapers, magazines, and advertising materials, gather all the information to be found relative to all of the clay industries in this country, including brick, tile, sewer pipe, crockery, fire-clay products, dishes, and art vases. Find out as much as possible about the processes. Fire clay is fired at much higher temperatures than other clays. Ries says that no clay should be called fire clay unless it fuses at a temperature above Cone 27, which is 3038 degrees Fahrenheit. It is used where very high temperatures are needed. In making crucible steel, the crucibles for melting the iron ore and mixing it with the manganese and other materials that may be needed are made of fire clay. The walls of the kiln where pottery is fired are lined with fire clay. Some stoves are lined with fire clay.

Bricks are of various kinds. Some are highly glazed. Some others have a cheap glaze on them which is produced by throwing salt in at the top of the brick kilns. It melts and runs down over the bricks. *Vitrified* bricks are bricks which have been heated to such a high temperature that the particles or grains melt and fuse, closing the pores so that they are impervious to water. These vitrified bricks are sometimes called *steel-hard* bricks.

Sewer pipes are quite commonly used. Tiles are similar to the sewer pipe except that they lack the rim for making tight joints and that they are fired at a much lower temperature, leaving them porous. Tiling is used to drain swampy or wet land. The tiles are laid in ditches far enough below the surface to be out of the way and to prevent freezing. They are laid, end to end, in rows from a few feet apart to a few rods apart as needs require. In addition to draining off superfluous water, they permit the ground to be well aired, which helps to prevent it from packing. Land that is almost worthless because of its wetness is frequently made very valuable by drainage with tile.

The use of flat tile in bathrooms and in floors is usually well known. In some communities the picturesque tile roof will be familiar. The use of hollow tile for walls of houses is becoming increasingly frequent. With tile roofs, tile floors, tile walls, brick fireplaces, brick chimneys, tile drainage, clay dishes, clay vases, and clay pipes for insulating electrical wiring, one can almost feel that we live in clay houses, although they are very different from the all-clay, adobe houses of some regions.

Comparing our clay industries with those of other nations. Gather data from the World Almanac and other available sources about the clay products of all nations. Make graphs setting forth the facts found. Note which nations lead in volume of product in the various phases of the clay industries. Does volume of business necessarily mean greatness? What other element should be considered in determining which are the great clay manufacturing nations? What parts of the world seem to be well supplied with excellent clay?

Estimating the increase in value of clay by work put upon it. Find the price of clay per pound. Do the same for glazes. Weigh some dishes and vases. Estimate the cost of the clay and glazes used in their manufacture. Find the prices of these dishes and vases in the stores. How much has the value of the materials been increased? Which is more expensive, the materials or the labor? Do the same for bricks and tiles. Where is the greater increase in value — in making clay into dishes and vases, or into tiles and bricks? Are there differences in the degrees of skill required of workers in the two fields of production?

Finding out what clay is. Look in books of reference to find what is given about the nature of clay. Get some dry clay. Examine it. Rub it with the hand. It is a very finely divided material which is the resultant of the decomposition of feldspar. Its peculiar properties are its plasticity when wet and its action under heat. When heated to the right degree, these fine particles melt and run together. So, when fired, the carefully made vase changes from a thing made up of millions of separate particles crowded closely together to a vase made of one solid piece.

What caused the decomposition of the feldspar? The geographies give descriptions of the processes of erosion and decomposition which are now taking place. One other agency has been responsible for much of the clay we use. The glaciers which swept over much of our continent ground rocks to small particles. Feldspar was one such rock. This feldspar, so ground, was washed down in the glacial waters until finally deposited in beds of clay.

Finding how the clay beds were deposited. Why do we not find, instead of clay beds, beds of gravel, sand, and clay, all mixed together? They were all washed along in these turbulent waters. An experiment may answer the question. Put some rock, gravel, sand, clay, and water in a milk bottle or a fruit jar and shake until all are thoroughly mixed. When the shaking is stopped and the vessel is at rest, the rocks and gravel settle to the bottom immediately. After a little, the sand is seen to be at the bottom on the rocks and gravel with the clay water above. Let the vessel remain quiet for several hours. The water will be found to be clear and a thin layer of clay can be seen above the sand. The clay bed is not mixed with the sand and gravel because it will not deposit until the water is quiet a long time, while the others in depositing do not wait for quiet waters. Wherever one sees a bed of clay, he may know that at one time that place was covered with muddy clay water which remained quiet for some time. Note where clay beds are to be found.

Some geologists believe that there was once an ice dam in the vicinity of Cincinnati,[1] due to the ice of the glacial waters coming down off the Alleghenies and becoming jambed there. If this were true, what evidence of it would we find in this vicinity? What industry, prominent in this region, seems to support this view of the geologists?

Investigating the making of paper and cardboard boxes. Fancy bóxes made for gloves, handkerchiefs, and other special purposes are made by hand methods. Training for this work, requiring from eight months to a year, is offered in some girls' trade schools. The cheaper, common paper and cardboard boxes and cartons used for groceries, shoes, suits, and many other purposes are made by machine methods and processes. Little training for this work is required, and workers are often very poorly paid. Many girls and some boys go into this occupation because the work can be learned easily. But the chances of promotion to better paying work as they grow older are very few. For most workers, it may be described as a " blind alley " occupation.

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[1] Wright, G Frederick — *The Ice Age of North America*, p 326.

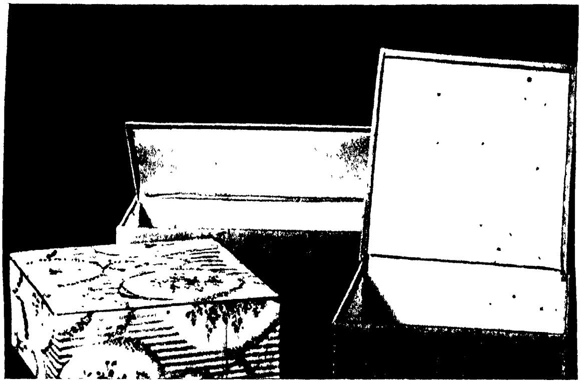

FIG 181 Handkerchief Boxes

Examine a number of paper and cardboard boxes, noting the various ways of constructing them. Find the address of a factory making these kinds of boxes and write asking for any printed matter they may have descriptive of the work. Consult the matter descriptive of the work of a paper mill to see what is said of papers and cardboards used for making boxes. Making paper bags may also be investigated in this connection.

Finding how a handkerchief or glove box is made. To give insight into hand forms of paper-box construction, a handkerchief or glove box may be carefully taken apart, and the materials and forms of construction work noted. The principles are the same as those used in making all common forms of novelty boxes. If it is desired to make such a box, the method may be developed by a careful study of the box taken apart, noting the respective pieces, their sizes, and the methods of placing and pasting them. The materials required are wood-pulp or cloth board for the body; white cotton poplin for lining; tough and moderately stiff paper for foundation for lining walls and pads and for finishing the bottom; cotton sheet wadding for the pads; muslin for reinforcing the corners; super or cheesecloth for strengthening the hinge; linen, silk, or cretonne for the cover; and paste.

Make a list of the various articles known to be made by this method of construction. What are the limitations of such utensils in a home? Can they be cleaned? For what purposes are they appropriate? Do they last long?

Tabulating the facts obtainable about the glass industries. Gather such material as is available on the glass industries, to show their importance and the various phases of these industries. Make a chart showing these facts. Examine various forms of glasswares to be found in homes and in the stores and shops. Read what you can find about the art of stained-glass windows. See the chapter on Shelter, page 256.

Making copper bowls. Copper bowls can be made by children of this grade, but the work is too noisy for most school situations. If bowls are made, number 20 gauge sheet copper is desirable. Hollow out one end of a maple block into a shallow bowl shape, using a gouge. Cut a four-inch square of sheet copper. Describe the largest circle possible and cut. Using a round-headed hammer, hammer the copper into the bowl shape in the block, beginning in the center and turning constantly as you hammer. Hold the sheet of copper in the left hand and hammer with the right hand. When the copper becomes hard, heat on a gas stove until very red, and plunge into cold water. This *anneals*, or softens, the copper. Continue the hammering, directing the shaping of the bowl by the position in which you hold the copper with the left hand. Avoid wrinkles, or buckles, by keeping them hammered out before they become short and sharp. If left, these wrinkles may cause cracks. When properly shaped, finish the surface with the planishing hammer, holding the bowl over a round-top stake. This gives a surface of facets, characteristic of hammered copper. Trim the top edge true with shears. Round and smooth the edge with emery cloth. To flatten the bottom, place upside down on the table and find the center with a pair of dividers. Draw a circle the size of the bottom desired. Take a wooden mallet and strike down on the center with light strokes, working around to the circle drawn. Mix pumice stone and water, and polish the bowl. To color, rub with turpentine and heat gently. Too much heat burns off the turpentine.

Etching designs upon the bowls or upon pins. Draw the design on paper as a copy. Pour melted beeswax over the copper surface. Trace the design upon the wax. With a knife, or hat pin, or toothpick cut the design through the beeswax. Pour nitric acid into the design and allow it to eat the copper surface. Wash and remove the wax. Nitric acid should be in the hands of the teacher only.

Some etchers cover the copper with a mixture prepared by melting two ounces of white wax; adding one ounce of gum-mastic in powder, a little at a time, stirring until the wax and mastic are well mixed; and adding in the same manner one ounce of bitumen in powder. This mixture is applied by wrapping a ball of the mixture in a piece of silk and rubbing upon the copper surface.

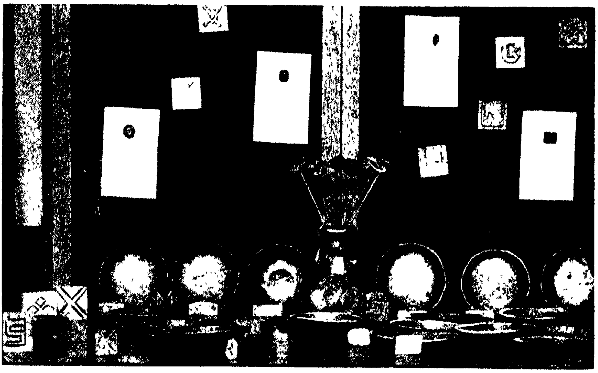

FIG. 182. Metal Work of Fifth- and Sixth-Grade Children

If stickpins or hatpins are made, it will be necessary to buy pins to attach to the etched copper heads. Those pins prepared with a cup, for soft soldering, are best. Brighten the copper at the place where the pin is to be attached, and

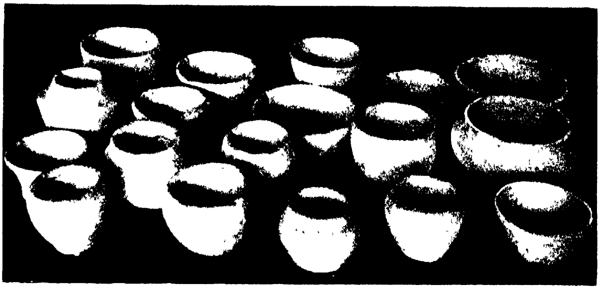

FIG. 183. Bowls Made by Fifth-Grade Children, Ready for Firing and Glazing

also brighten the cup. Moisten these with soldering fluid. This can be bought or made. To make, put some chemically pure muriatic acid in a glass jar, add some shavings of pure battery zinc, allow to stand for fifteen minutes, add more shavings, and continue until all chemical action ceases. Allow to stand overnight. Pour off the clear fluid for use as a soldering flux.[1]

Heat both pieces of metal equally hot, touch the cup with a piece of soft solder, filling it, and apply at once to the pin.

Find what you can of the hammered metal industries. Include work in brass, silver, and other metals used in these industries. If there are any examples of fine workmanship in the community, see them if possible. What gives value to such pieces? Compare them with the pressed metal bowls, lamp shades, trays, and similar articles on sale. Wherein do they differ? Why the difference in price?

Desirable outcomes in Grade V. From this work the teacher may expect:

1. A rather definite knowledge of how to make a one-piece, a two-piece, or a three-piece mold for pottery.
2. Knowledge of how these molds are used in making ware.
3. Ability to distinguish with some accuracy coil-built, wheel-made, and mold-made pieces.
4. A rather definite knowledge of American potteries and the characteristics of their products.
5. Some notion as to the variety and amount of clay products in this country in comparison with those of other nations.
6. Some judgment as to the worth of materials and products in terms of the work done upon them.
7. Some understanding of the geological history of clay beds.

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[1] Thatcher, Edward — *Simple Soldering* Spon and Chamberlain.

8. An increasing interest in clay industries and recognition of their importance.
9. Some insight into the glass industries and their extent.
10. Some judgment relative to the extent of the paper-box industry and the status of its workers
11. Some interest in hammered metal utensils.

GRADE VI

Finding out how a glaze is made. It will be recalled that in Grade V, page 339, it was mentioned that salt thrown into a kiln of brick would form a glaze upon the bricks. Similarly, white lead will make a glaze of poor quality. The lead makes a soft, easily scratched glaze. Adding flint makes a glaze harder. The more the flint, the higher the temperature required to melt the glaze. The more the lead, the lower the temperature at which the glaze melts. The other materials customarily used in glazes are feldspar, white China clay, and whiting. These are mixed in varying proportions according to the kind of glaze wanted. The color is usually the oxide of a metal.

There have been many glaze mixtures used by potters. The following are here included to give some idea of the constituency of glazes.

Enamel glaze — as made by Mr. Leon Volkmar:

35	parts dry white lead
25	parts powdered feldspar
30	parts powdered flint
5	parts whiting
5	parts China clay
5	parts white oxide of tin
105	

This makes a white enamel. To give color, add oxides of metals, not over four parts to the above. Black oxide of cobalt, two parts, gives blue; black oxide of copper, two to four parts, gives a good green, rather silvered in tone; green oxide of nickel, two to four parts, gives gray; red oxide of iron and black oxide of iron give varying shades of brown and tan; black oxide of manganese gives a tone between purple and brown; yellow oxide of uranium gives a tan-yellow; and for a light blue-green, use one-fourth part of cobalt and one part of copper oxide. A blue-gray can be secured by using combinations of nickel and cobalt, not exceeding four parts as a total. A brown-green can be obtained by combining copper and iron. Two parts of black

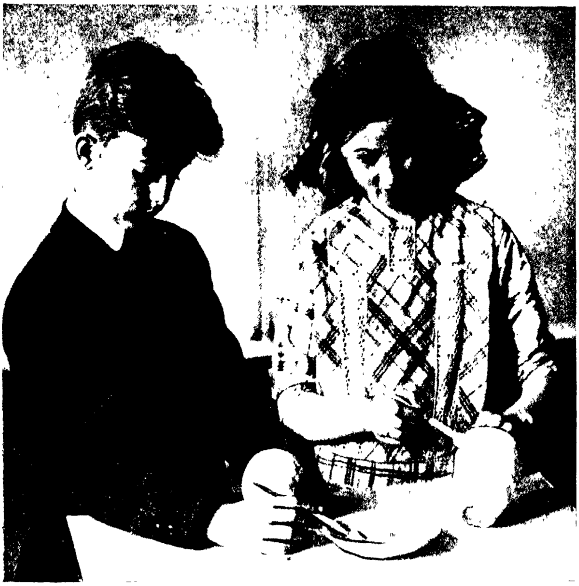


FIG. 184. Applying Glaze with a Brush

oxide of copper, one-half part of black oxide of iron, and one-half part of green oxide of nickel give a light yellow-green.

To prepare a glaze: Weigh out the colors and grind thoroughly with water, using a muller and ground glass slab, or a mortar and pestle. The former is preferable. Add the enamel ingredients and mix and grind with water. To this amount add one teaspoonful of gum Arabic to make the glaze stick to the pottery before being fired, and one teaspoonful of gum tragacanth to make the glaze flow smoothly from the brush. Grind to the consistency of a moderately thick cream.

To glaze: Make a thinner glaze of part of the above. Pour into the vase or bowl, which has already been fired at Cone 1 or 01. Pour around the walls, rolling the vase in the hands, and empty it quickly. This makes a thin coat, less likely to crack than if a thicker glaze were used inside. For the outside, apply a coat of the thicker mixture, using a full brush and a lapping or cross-hatching stroke. Do not brush the glaze on as in painting. Allow this coat to dry. Apply a second. Dry. Apply a third, not so thick, finishing with a smooth surface. Put one thin coat on the bottom. Fire this glaze at Cone 02. The total coat applied should be a little less than one-eighth of an inch thick.

Since there is a glaze on the bottom of the pottery, the pieces must be set upon stilts, or tripods, in the kiln. Place the pieces so that at least one-half inch intervenes between each two pieces. It requires about twelve hours to fire this glaze in an oil kiln.

Inside glaze: The following recipe, by Mr. Leon Volkmar, makes a good inside glaze, tan in color:

50 parts dry white lead
23 parts powdered flint
15 parts whiting
15 parts China clay

Matt glazes: These matt glazes, made by Mr. Charles F. Binns of Alfred University, Alfred, New York, fire at Cone 04:

White Base Matt	Green Base Matt
142 parts dry white lead	111 parts dry white lead
25 parts whiting	25 parts whiting
111 parts powdered feldspar	111 parts powdered feldspar
22 parts calcined kaolin	22 parts calcined kaolin
13 parts Florida clay	13 parts Florida clay
	9 parts black copper oxide

Blue Matt Glaze

134 parts dry white lead
25 parts whiting
111 parts powdered feldspar
22 parts calcined kaolin
13 parts Florida clay
2.4 parts black oxide of cobalt

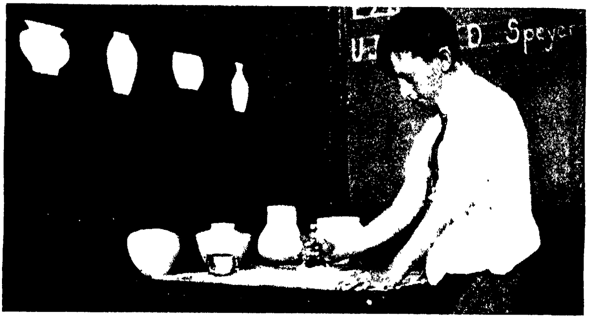


Fig. 185. Grinding Glaze with a Muller and Slab

Variations in method of mixing glazes: The potters usually find out, by experiment, just the glaze they like. Very exact weights are used in measuring out the quantities when right proportions are determined. These must be thoroughly ground together to mix the particles completely. If the quantity is small, a ground-glass slab and a ground-glass muller are used. The ingredients are mixed with water enough to make a creamy mixture, and then are ground and ground and ground. A spatula is used to keep the mixture on the glass. For large quantities, a glaze mill is used. It is a stoneware jar, covered inside and out with a hard glaze, fitted with a tight lid, and fastened with bands of metal into a frame attached to a motor to revolve it. In it are a number of very hard marbles. The mixture is put into this mill. The revolving, combined with the action of the marbles, mixes it thoroughly.

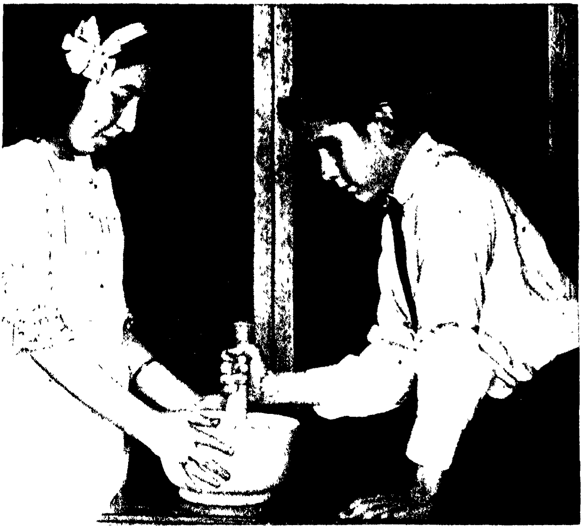


FIG. 186. Grinding Glaze with a Mortar and Pestle

These are sometimes used instead of the muller and slab but the process takes longer.

To a mixture of about 100 grams, or 3.5 ounces, a teaspoonful each of gum Arabic and gum tragacanth is added.

Firing the glaze: When the glaze is fired, it melts at the temperature which its composition calls for. This means that the potter needs to know what the composition of the glaze is which he is using, and he needs to know how hot to make his kiln, for the heat must be turned off as soon as the glaze fuses.

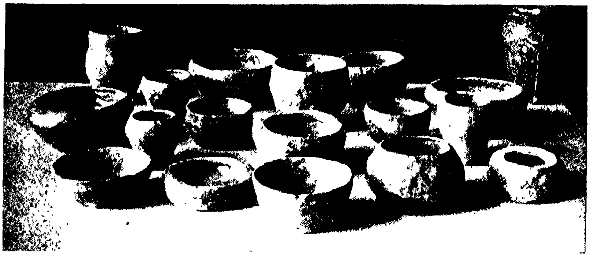


FIG. 187. Pottery of Sixth-Grade Children in the Green-Ware Stage

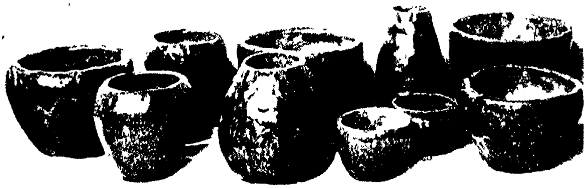


FIG. 188. Glazed Pottery Made by Sixth-Grade Children

In firing a kiln of bricks or crocks or tile, the potter depends upon the appearance of the interior of the kiln as he looks through a peep hole. But these products are unglazed, or glazed with salt or with a low grade of glaze. In firing a kiln of china, the delicacy of the glaze requires a much more careful method. To aid the potter, there have been devised what are called *cones*. They are triangular pyramids about three inches high and a half inch on each side of the base, made of a red clay mixture. The clay has been scientifically tested so that the makers know at exactly what temperature the clay will melt. When a cone does melt, the point bends slowly over. If the firing is continued long enough, the cone will melt flat on the support on which it rests.

The cone with the highest melting temperature is Cone 39, firing at 3470° F. The numbers from this in descending series are 38, 37, 36, . . . 2, 1, 01, 02, . . . 022. Next lower than Cone 1 is Cone 01, which fires at 2102° F. The lowest, 022, fires at 1094° F. All glaze mixtures have definite firing temperatures, the point at which the glaze fuses.

When the potter sets his kiln, he puts two cones in the front of the kiln and two in the back where he can see them through the mica windows arranged for this purpose. One of each pair is for the temperature at which his glaze melts. The other is usually two cones lower. The lower cone serves as a warning to him. When he sees it go over, he knows he must keep close watch to be ready to put out the oil or gas flame, or to draw the fire if he is burning coal or wood, when the other cone begins to go.

Summarizing the different ways by which vessels are decorated. As already noted, salt is used only for things which require a very poor glaze. Crocks and jugs are glazed after drying, before firing. They therefore require but one firing. Dishes and vases of a better grade are fired, then glazed, then fired again. The first firing, called the firing of the green ware, is obviously at a higher temperature than the second;

otherwise the second firing might melt the results of the first firing. The second firing is called the biscuit firing. In very fine grades of china, three firings are made. The first is the green ware. On the biscuit ware resulting, is placed the underglaze design. The second firing is to fix this. Then a transparent glaze is added before the third firing. Some less expensive dishes have the underglaze design put on before the first firing. This saves one firing, but it is likely to make a less dainty design.

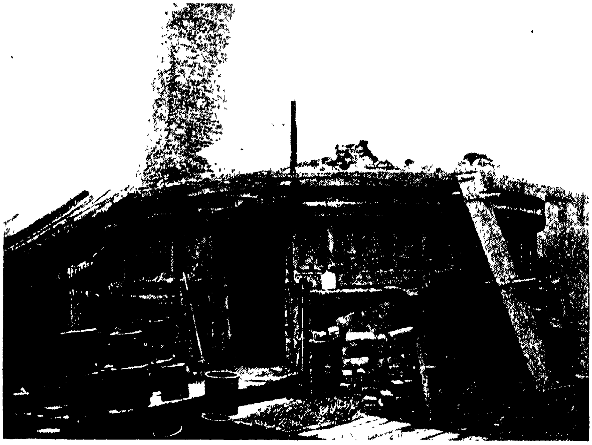
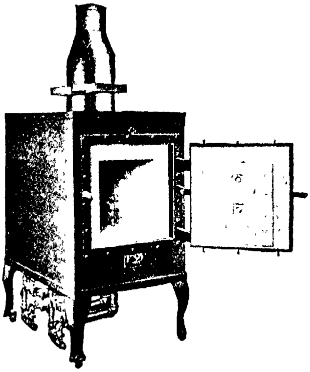


FIG. 189. A Kiln at Ripley, Illinois, for Firing Crocks, Jars, and Jugs

Some vases have what is called a drip design. They are painted with a glaze of one color; then a glaze of another color is painted around the top heavily enough so that it will run down irregularly and make an intermingling of the two colors when fired.

The underglaze pattern may be painted on by hand and is so done in craft work. But factories do not do so. It is easily seen that the expense of hand work would make prices too great. The underglaze pattern is put on by means of transfer paper, called decalcomania paper. This can be bought of Palm, Fechteler, and Company, 67 Fifth Avenue, New York City. It is applied somewhat as we apply certain kinds of Easter egg designs. Examine some dishes and find evidences that the design was put on with transfer paper. Matt glazes are different in composition from the bright glazes. Usually they require a higher temperature for firing.



Courtesy A. Drakenfeld, New York City

FIG. 190. A Kiln Suitable for School Use

Finding how kilns are constructed. Gather pictures of kilns of various kinds. Write to the manufacturers of kilns for copies of their catalogues showing the kinds of kilns they have for sale. The essentials in a kiln are an inclosed space in which the pottery can be placed in such a way as to be protected, and provision for intense heat. Note the methods of firing used by the Indians, described on page 299. Compare with the tile and crockery kiln in Fig. 189. If there is a brickyard or tile factory in the community, visit the kilns when in operation.

Exchanging industrial information with another sixth grade. If there is no pottery in your community, write to a group of sixth-grade children in a pottery town, asking them to write letters telling all they can find out about the

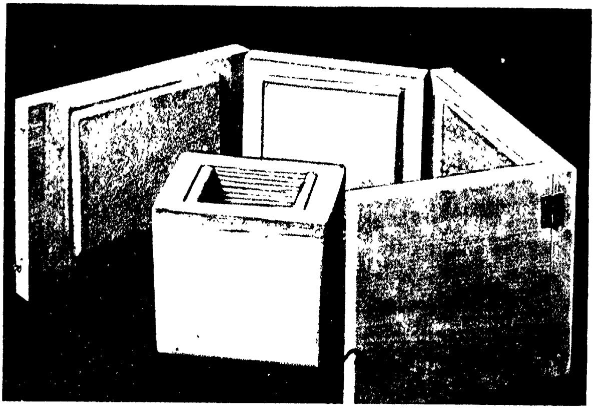


FIG. 191 A Hinged Outside Form with Insets for a Design Used for Making Concrete Pottery

The inside form is easily pulled out.

potteries in their town. In return, send to these children letters describing an industry in your community. In preparation for the letters to come, the children may well review the details of the processes involved in pottery making.

Making concrete pottery. By making wooden forms and filling these with a fine grade of concrete, flower pots and boxes, urns, drinking fountains, and other models of concrete pottery may be made. Several illustrations are

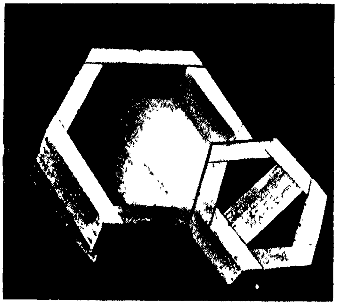


FIG. 192. Outside and Inside Forms for a Hexagonal Flowerpot

here given to show different methods by which parts of forms may be fastened together to permit of the easy removal of the piece of pottery when hardened. Variety in design is secured by building the form to produce the desired shape, and by using coloring matter in the concrete.

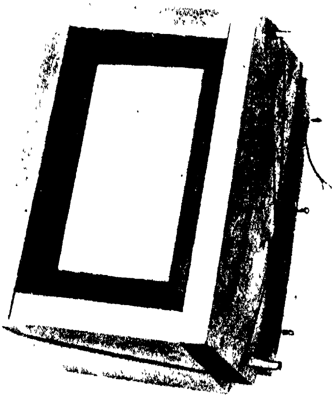


FIG. 193. A Form Constructed for Pouring the Pottery Upside Down

Summarizing elements to be considered in buying clay products for the home. The children should be led to apply the knowledge obtained in this work in making judgments of what designs, colors, and qualities are most appropriate in a home. How expensive should be the dishes used commonly? What pieces and how many are needed for a family of six? To provide for twelve?

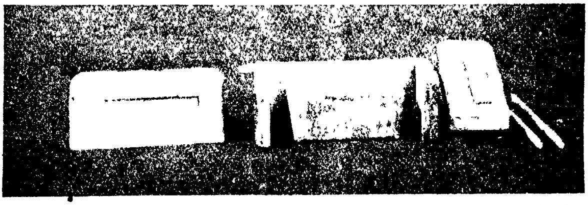


FIG. 194. Outside Form Held Together by Screw Eyes and Dowel Rods; Inside Form Shaped for Lifting Out

What does a set of one hundred pieces cost? Finding the wide range of prices, one should consider other elements. For constant use, the design and color should not be so obtrusive as to become tiresome. They should be bright, cheering, and ever attractive. Durability should be considered, not only for the sake of economy, but because one becomes attached to an attractive set and it becomes a part of the home. The question of the color of dishes should include consideration of what will be used with or near the dishes. Simplicity is always a safe quality.

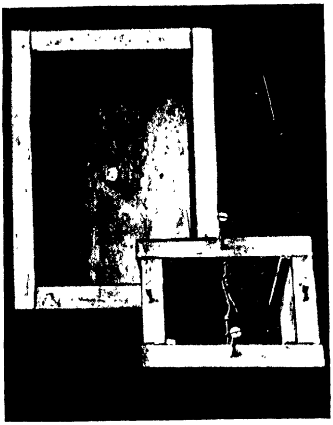


FIG. 195. Collapsible Outside and Inside Forms

When one thinks of vases in a home, he usually thinks of a chance collection. Why should not the vases harmonize with other things in a room? Their color should not violate the color scheme of the room. A vase has for one of its functions the holding of flowers. It should show forth the beauty of the flowers, not rival them. Hence, vases of neutral and " background " colors are desirable for this purpose. The sizes and shapes should be such that flowers of various kinds may be cared for. There should be vases for large, coarse flowers, bowls for violets and nasturtiums, tall vases, slender vases, broad, generous bowls, and so on. These ought not to be of the very expensive kind, easily broken by careless handling.

Simplicity, utility, grace of line, harmony of color, and individuality are qualities to be considered. The schoolroom may well teach such considerations in fitting vases to flowers. The school should have an assortment of vases and bowls, inexpensive, but varied in dimensions, line, and color. As flowers are brought to school, thought should be given to their placing in vases so that the boys and girls may learn the beauty of a well chosen vase.

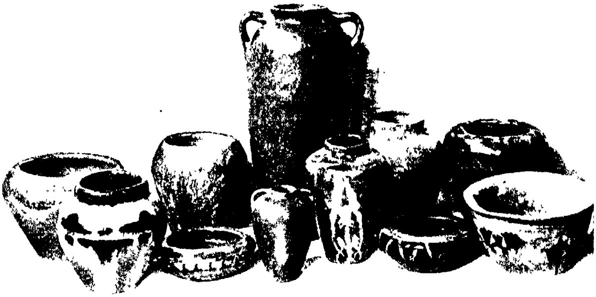


FIG. 196. Results of Experiments in Glazing

Desirable outcomes in Grade VI. From this work the teacher may expect:

1. A quite clear idea of the process of making a glaze and of controlling its firing.
2. Knowledge of the essentials in kiln structure.
3. A rather complete understanding of all of the common processes in pottery making.
4. A keen interest in the pottery industry.
5. Growing good taste in choices of vases and dishes.
6. Some idea of prices to be paid for good pottery.
7. Appreciation of good pottery.

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CHAPTER XI

SUGGESTIONS FOR THE STUDY OF RECORDS

GRADE I

The sources of books, magazines, and papers of the home. In considering home life, the part performed by books, magazines, and newspapers should be noted. Where they come from may be discussed, and this should lead to a trip to a bookstore to see the books being unpacked and put upon the shelves for sale. In answering the questions asked about how the books are made, a trip to the printing office to see type-setting and press work will answer in part. The discussions of the store and printing office should bring out the ideas of how the books, magazines, and newspapers are provided for the family, and of how much work is done in making them for us.

Beginning a library. The value of books and magazines as a source of enjoyment should lead to starting a schoolroom library, or reading table or shelf. Proper ways of caring for books in placing them on the selves, in handling them when reading, and in marking their ownership should be taught.

Using a printing outfit. The children will want to use a simple printing outfit in making signs or labels or in printing original stories and poems. The similarity of this method to the job type-setting seen in the printing office should be noted.

Making booklets. These original stories and verses will suggest the need of booklets; or, pictures collected or made in connection with some investigation will demand some means for mounting and keeping them. The children can meet these needs by making a single-section booklet. To do this, fold through the middle the desired number of sheets. In the crease, make three holes through all the sheets. Put a threaded needle from the inside through the middle hole to the outside, leaving about two inches of thread hanging on the inside. Return the needle through one of the other holes to the inside. Put it through the middle hole again, and back inside through the third hole. Tie with the end left hanging. If a colored ribbon is used, begin on the outside in first going through the middle hole, and this will bring the bow on the outside.

The outside sheet becomes the cover of the booklet. If desired, a tougher paper, or one of different color, may be used for the cover.

Finding out what paper is. The question as to what paper is will probably be asked. In answering, compare paper with the hornet's nest to bring out resemblances. Some notion of what material is used and a little idea of the process can be secured through inquiring of others and bringing the ideas together in class discussion. The teacher is referred to the work of Grade V in this chapter for a description of the essential processes of paper making.

Desirable outcomes in Grade I. From this work, the teacher should expect the children to develop some notion of:

1. The sources of books, magazines, and newspapers.
2. How they are printed.
3. How a booklet is made.
4. How books are cared for and labeled.
5. What is used in making paper.
6. The general process of paper making.

7. Interdependence of people as shown by the work of many in providing reading material.

8. Books, magazines, and newspapers as a valuable source of information and entertainment.

GRADE II

Learning library methods of charging books. By this time, there should be a definite effort to interest children in reading whole stories. Every means should be used to bring together a number of the interesting stories available for this age. The reading of these may well displace part of the time usually given to the textbook for reading. As the number of these books increases, the children will begin to feel the need for knowing where the various books may be found. Now is the time to teach the library method of charging the books to readers. A visit to the library will enable the children to learn what the correct method is. Regular library cards can be procured. Pockets for the cards can be made by the children similar to those seen in the library books. The correct method of writing the grade, owner's name, author's name, and the title should be followed. In this way the children will learn to value library methods and rules. A different child should be appointed librarian each week. The library trip may also be used in showing the children the correct way of opening a new book.

Making cover designs for booklets. Make such booklets as are needed for recording school experiences. Suggestions for needed booklets will be found in connection with work in foods and some other problems. When the question of appropriate cover designs for these arise, the children can make a collection of booklets and magazine covers to find out what is essential in a cover design, what colors may be used, what the design tells one, and what kinds of letters may be used. Try stick printing as one method of making a decoration on the cover. Design, spacing, and lettering require consideration, not only in the making of cover decorations but also in the making of charts and posters.

Collecting different kinds of paper. Make a collection of different kinds of paper suitable for the leaves and covers of booklets. Note the colors, and such qualities as toughness, smoothness, thickness, and the ease with which one may write on the various kinds.

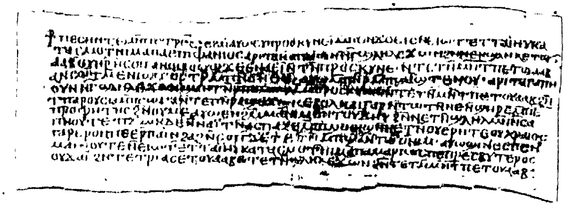
Desirable outcomes in Grade II. From this work the teacher may expect:

1. Some knowledge and use of library methods of charging books.
2. An interest in design of covers of books and magazines, and some ideas of choice in line, color, and spacing.
3. Some knowledge of variety in paper and the uses of particular kinds.
4. Some desire and effort to express ideas and feelings of beauty in book covers, cards, posters, charts, and written work.

GRADE III

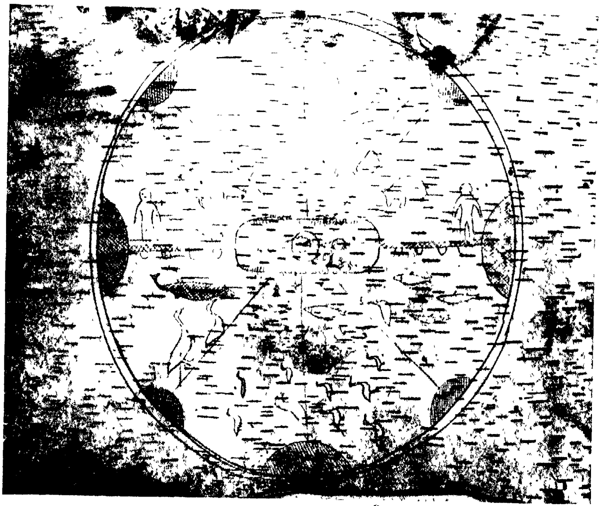
Making parchment. Stories of early Hebrew life are appropriate for children of this age. In these stories, mention is occasionally made of the scroll, or roll, as the Hebrew book. To help the children to value our ways of making books, they may well get a somewhat detailed knowledge of the Hebrew method of ancient times. Parchment was the material used in making a scroll. What uses are made of parchment to-day? To make a piece of parchment, procure a piece of fresh sheepskin. Soak it in lime water for a week. This will loosen the hair so that it can be pulled out. Dry the skin, stretching it on a frame. When dry, scrape it smooth. Rub with powdered pumice and chalk.

This will make it smooth enough to write upon. Powdered pumice can be purchased at almost any drug store.



Courtesy Metropolitan Museum of Art

FIG. 197. A Papyrus Coptic Inscription from Thebes, Seventh Century, A. D.

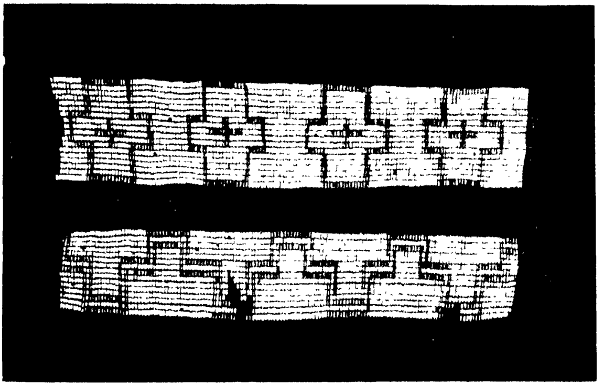


Courtesy Metropolitan Museum of Art

FIG. 198. Ojibway Writing on Birch Bark

Making a scroll. Use the parchment just made, to make a scroll, cutting a long, narrow strip. Attach a stick at each end to use for rolling the scroll. References to the scroll or roll will be found in: Isaiah 8:1, and 34:4; Jeremiah 36:2, 6, 23, 28, 29; II Timothy 4:13; and Revelation 6:14. Read from some of these, particularly the references in Jeremiah.

Finding out how other peoples made records. Collect pictures and accounts descriptive of the Egyptian papyrus. Excellent photographs can be procured from the Metropolitan Museum of Art in New York City at from ten cents to forty cents each. This writing material was made from the pith of the papyrus plant. A layer was made with the stalks lying parallel and close together. A second layer was laid over the first with these stalks at right angles to the others. A

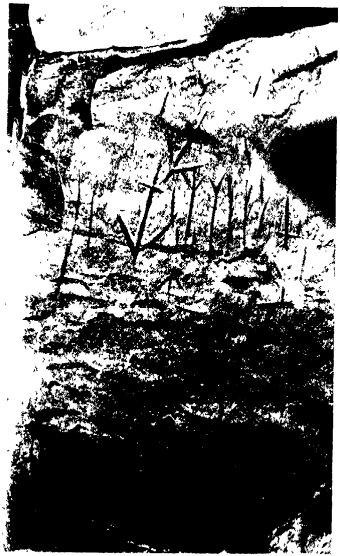


Courtesy Museum of American Indian

FIG. 199 A Wampum Belt Record

The William Penn Wampum Belts presented to Penn by the Delaware Indians probably in the ratification of treaties. These are on exhibition at the Museum of the American Indian, Heye Foundation, New York City.

heavy weight was used to crush or roll the mass flat. The natural gum in the plant gave it a unified body. An artificial filler may have been used at times. Some pictures of papyrus show the lines at right angles to each other. Can you see how we probably got our word *paper?*



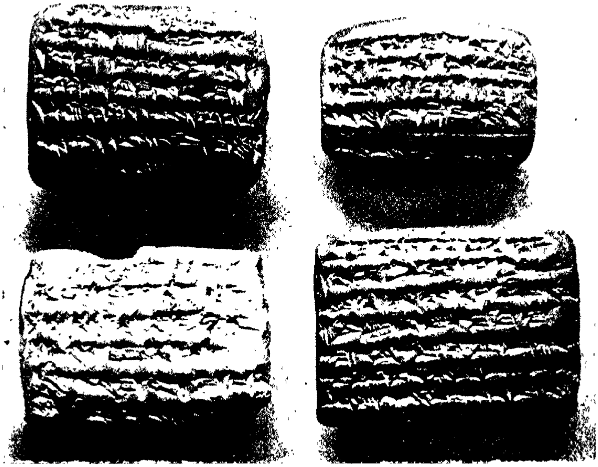
Courtesy American Museum of Natural History

FIG. 200. Indian Records, Called Petroglyphs, on Sandstone Cliffs in Weston County, Wyoming

The Indians wrote by making pictures on birch bark. Good illustrations of their writing are found in a number of books on history. The Indians used a knotted string or a notched stick at times for keeping certain kinds of records. Some of them also made records on stone cliffs. See Fig. 200.

The Babylonians used clay, which was made into tablets shaped somewhat like shredded-wheat biscuits. Sometimes the tablets were much thinner. With a three-cornered instrument, the inscriptions, called *cuneiform* writing, were made in the clay before it was dry. If the record was very important, a second layer of clay was put on to cover the first and the surface of this was inscribed with the same record that was put upon the first surface. Illustrations of Babylonian tablets are here included.

The early Assyrians inscribed their accounts upon the rocky surfaces of cliffs. Sometimes they, and the early Hebrews, made a pile of rocks, or cairn, to mark a significant place in their experience, just as one may find in the Southwest in this country piles of rocks near a lonely Mexican cemetery to mark the places where the body of the beloved was set down by the carriers while they rested on the journey to the grave.



Courtesy Metropolitan Museum of Art

FIG 201. Babylonian Writing on Baked Clay Tablets

The Romans wrote on waxed tablets, using a pointed metal instrument called a *stylus.* Compare this with our dictaphones as to materials used for a writing surface.

Comparing modern methods of writing with historic. Compare these various materials with what we use. Explain why all nations did not use the same material. What advantages can you think of that paper has over the other materials? Why are books and newspapers now more plentiful than in earlier days? Why cheaper? Make a list of all of the materials we use in making paper and cardboard.

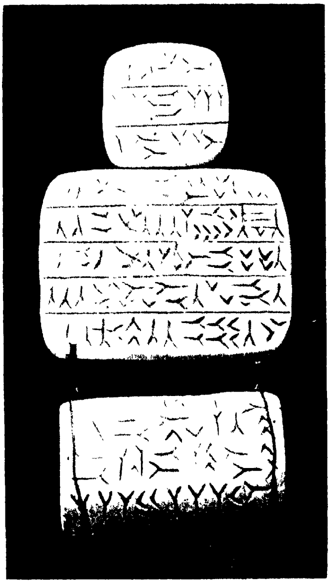


FIG. 202 Models of Babylonian Clay Tablets Made in School

Binding pamphlets. In gathering material about the history of writing materials, some pamphlets worthy of place in the class library may be procured. Or, valuable information in geography or other subjects may be obtained in pamphlet form. Pamphlets are easily torn or otherwise damaged. Librarians bind all they think worthy of keeping. The children can do the same with theirs after they have seen some library-bound pamphlets.

These binders, or case covers, used by librarians may be made as follows: Use Melton or other surfaced cardboard. Send for bookbinder's linen. It can be obtained of Louis De Jonge, 71 Duane Street, New York City. It is one yard wide and is bought by the running yard. Sample books are sent out to bookbinders, containing samples of the various colors and materials. Cut two pieces of cardboard as wide as the pamphlet and one-half inch longer. Cut a strip of bookbinder's linen three inches wide and one and one-half inches longer than the boards. Paste the two boards on the linen, leaving a one-half inch space between the two boards and allowing the linen to extend three-quarters of an inch over at each end of the boards. Cut a strip of stiff manila

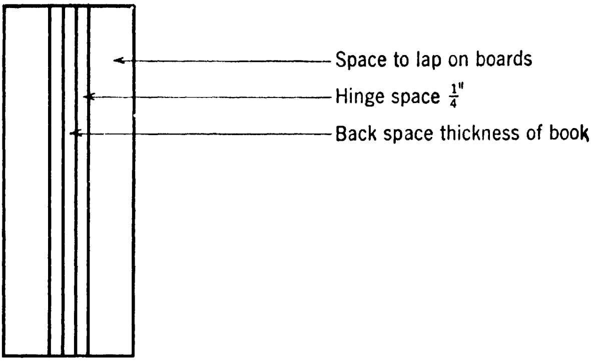


FIG. 203 Book Linen Ruled Ready to Apply the Boards

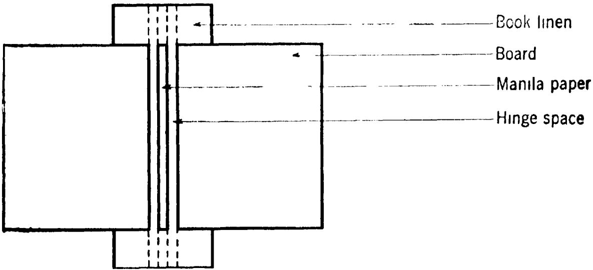


FIG. 204. The Boards Applied to the Book Linen

paper as wide as the pamphlet is thick and just as long as the boards. Paste it into place for reinforcing the linen between the two boards. Turn over the extensions of linen at the ends and paste down.

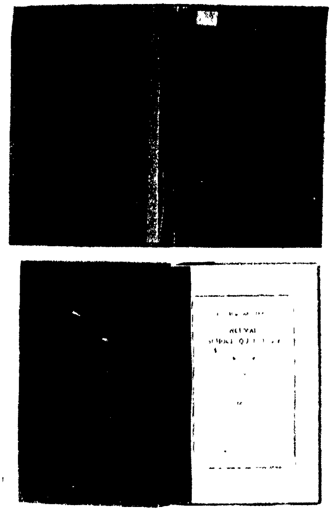


FIG. 205. Case Covers

The upper one is a commercial cover such as librarians use. The lower one, in which a pamphlet is bound, was made by the directions given in the text.

To place the pamphlet in the case cover, one needs what is commercially known as Gaylord tape. This the children can make. Cut two strips of linen three inches wide and just as long as the pamphlet. Place the right surfaces of the two strips together. Crease the two down the middle lengthwise. Sew them together along the crease, using the back stitch. Paste one piece of the linen along the back of the pamphlet and the other along the back on the inside of the case cover.

Procedure in pasting. In all pasting, the following procedure gives good results: Prepare sheets of newspaper, cutting the ordinary sheet of a daily newspaper into quarters. Stack these evenly and lay down on the working surface. Lay the piece to be covered with paste right side down on the top piece of newspaper. Holding the piece to be covered in position with three fingers of one hand, spread the paste evenly. Be sure to cover all spots and to put on only enough to cover. No time should be lost after the paste is on the material, for linen tends to stretch and paper to wrinkle if it lies long with paste on it. Lift by two corners the piece covered with paste. Lay it in its exact desired position. Fold once the piece of newspaper just used and put aside as waste. This folding once prevents coming in contact with chance paste on the used newspaper. Using the top clean sheet of newspaper, cover carefully the pasted piece just placed in position, and rub smooth so that all blisters disappear, using the edge of a bone folder or a ruler to do the rubbing. All pasting should be done on this pile of pieces of newspaper, and the soiled sheets should be immediately eliminated by folding and putting with waste.

Making paste. To one-fourth of a pint of boiling water add one teaspoonful of powdered alum. Allow it to cool. Add enough flour to make a creamy mixture. Add to this one teaspoonful of powdered rosin. Stir until smooth. Pour into this mixture, slowly and steadily, a little over a pint and a half of boiling water, stirring constantly over a fire to cook the paste but not allowing it to boil. Add a few drops of oil of cloves to keep it sweet. When it becomes sour, paste is useless. This will make one quart of good paste. Keep in a tight jar in a cool place. Steko, for sale by Louis De Jonge, 71 Duane Street, New York City, and Embeco, by the Milton Bradley Company, are paste powders ready to be mixed with cold water for use as needed.

Desirable outcomes in Grade III. From the work the teacher may expect:

1. An intelligent attitude toward paper as a writing material.
2. Some rather specific knowledge of the history of writing materials.

3. Some beginning of judgment of value in terms of handwork as compared with machine work.

4. An increasing interest in the library and its methods of caring for books and pamphlets.

5. Some ability to cut to measurements, estimate amounts of material needed, and handle paste.

6. A growing respect for books.

GRADE IV

Finding out how the alphabet was made. Collect materials and illustrations about the beginnings of the alphabet. Read the accounts to be found in histories and encyclopedias. *The Story of the Alphabet*, by Edward Clodd, gives a very interesting account of the beginnings. Compare these details with Indian picture writing and the cuneiform writing.

Finding out about the beginnings of libraries. See whether you can judge from Alma-Tadema's picture, "A Reading from Homer," what sort of records the Greeks had. Were books common?

What kinds of libraries would the Babylonians need for their clay tablets? Find an account of what they did to care for their records.

What would the Egyptians need for filing their papyrus scrolls? The papyrus was pieced and glued to make a long strip. Sometimes a scroll was eighty or ninety feet long. There is one in the British Museum, known as the Harris Papyrus, which is one hundred thirty-three feet long. Papyrus began to be made at least two thousand years before Christ and continued in use in Europe until the tenth century, after Christ.[1]

As a rule, papyrus was written on one side only, and was fastened to a rod or roller around which it was wound. The oldest rolls usually were written in lines across the width. Some Buddhists wrote the lines longitudinally of the roll. Sometimes the latter was placed inside a wheel which rolled it through sidewise. Passing the manuscript through the wheel was accounted as reading it. Prayers are sometimes rapidly "read" or offered in this way. Another arrangement was used, especially among the Chinese and Japanese. The material was arranged in longitudinal lines in a panel crossing the roll. A space was left between each two panels. The Jewish law was so written. The next step was to fold the roll along these blank spaces. The folded roll was punched along one edge and tied. Attaching boards to protect this, we arrive at a form suggesting the modern book. Slitting the folds along the edge not punched released as much more space for writing. Long before these steps had been completed, parchment had begun to displace papyrus. This material was in turn displaced by paper.

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[1] Smith, Adele.—*Printing and Writing Materials*, p 134 Avil Paper Co., Philadelphia.

There is a tradition that the town of Pergamos, in Asia Minor, became interested in establishing a fine library. The people of Pergamos bought their papyrus of the Egyptians. As you will find in your reading, the Egyptians were very proud of their library at Alexandria. They objected to the idea of a rival library at Pergamos. So they did the thing that to-day would probably be called boycotting. They refused to sell papyrus to the people of Pergamos, thinking this would end the rivalry. The effect was what one would expect to find among an ambitious people. Deprived of papyrus, the people of Pergamos began to look for a substitute, and they found it in a familiar material. They were a pastoral people having many sheep. They knew the use of the skin for tents, clothing, and water bottles. They found a way to prepare the skin, much as it is described in Grade III. So it came about that parchment became the material for writing generally used in Europe until the invention of paper.

Finding the use of bibliographies and card indexes. Compare what you can find out about the libraries of Babylon, Alexandria, Pergamos, Athens, and Rome with our libraries. Because of the ease with which we can make books to-day the libraries have very many to care for. Visit a city library and ask the librarian to show you how she keeps a list of all of the books. Have her show you how she can find a book quickly through the "author" card; also, how she can find what books she has relative to a given topic.

Making a bibliography. This comparison and the trip to the library should lead to the suggestion from the children or the librarian that anyone who reads much ought to keep a bibliography. The method of reading whole books mentioned in Grade II should have grown to some importance by this time. Further, the work in geography, history, and industrial arts, if conducted on the investigative basis, should be bringing to consciousness the fact that particular sources of information are sometimes difficult to recall.

For these reasons, the children may readily decide to keep a bibliography of the books read during the year, or of sources of information on important topics in geography, history, and industrial arts. When this time comes, the children should be taught the correct form of author cards and of subject cards. The details recorded and the form of placing them are important if the cards are to be most serviceable. Use the standard library card, three inches by five inches. Note that the author card has nothing on the first line. Otherwise it is exactly like the topic card in form. Note the margins. The title is the only line indented. Every book should have two cards — one an author card, the other a topic card. A book might have three or more cards if the material in it were to be found under several topics.

The children, together with the teacher, should formulate rather definite plans as to when they should make out bibliography cards, who should check the errors, and how they shall file them.

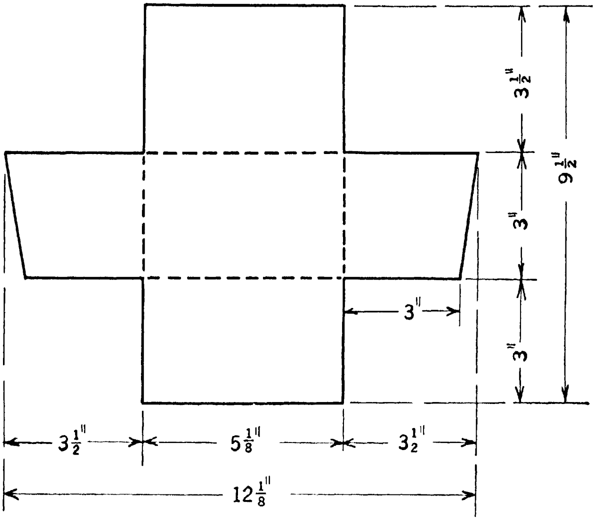

Fig. 206. Working Drawing of a Cardboard Bibliography Case

Making a bibliography case. It will soon become evident that a case will be needed to file these cards in alphabetical order. A very satisfactory one can be made of a smooth-surfaced cardboard and gummed tape. Cut the cardboard in the shape indicated in Fig. 206. Note that dotted lines should be scored, not cut. They indicate lines of folding. Fasten the back corners, 4″ in height, and the front corners, 2½″ in height, with gummed tape. Bind around the top with gummed tape. The appearance will be improved by putting the tape around the bottom also.

Making a cloth-covered case cover for binding a pamphlet or booklet. The pamphlets needing protection, or the notes needing binding, as they accumulate from investigations, may be worth a more pretentious case cover than that made in Grade III. One can be made covered with cloth. To do this, cut the boards as directed in Grade III. Cut the linen large enough to contain the two boards, leaving a half-inch space between them and allowing three-quarters of an inch extension beyond the boards all around for turnover.

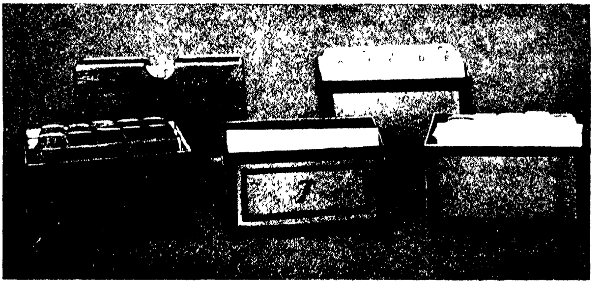

FIG. 207 Bibliography Cases

Four of these are made of cardboard One is of wood of the type suggested in the fifth grade

To paste the boards, lay them in their proper places. Mark lightly all around them on the wrong side of the linen. Remove the boards and paste as directed on page 372, putting the paste over the space inclosed by the marks. Gently press the boards into place. Turn the whole over on a newspaper. Lay a clean paper over the linen and rub smooth. After pasting the boards in place, paste the piece

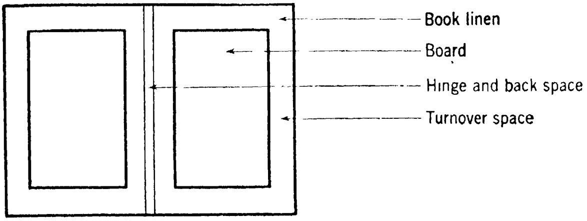

FIG. 208. Case Cover: The Boards Pasted in Place on the Linen

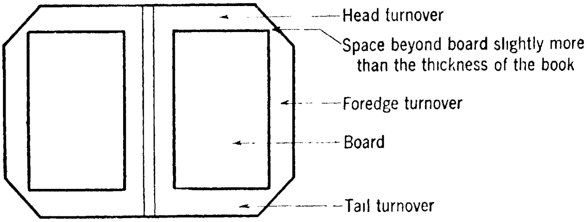
Head turnover
Space beyond board slightly more than the thickness of the book
Foredge turnover
Board
Tail turnover

FIG. 209. Case Cover: The Corners Clipped

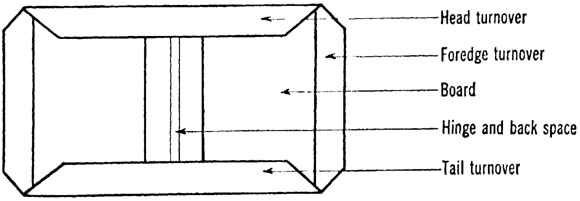

FIG. 210. Case Cover: The Head and Tail Turnovers Pasted in Place

of tough manila in place as directed in making the case cover in Grade III.

The next step is to cut the corners preparatory to turning the edges over. See Fig. 209. These lines should be three-

sixteenths of an inch away from the corners of the boards. For thick boards, the distance should be greater. Put paste on the head and tail turnovers. Place the bone folder or ruler under the edge of the newspaper upon which the case cover is lying. Lifting the newspaper, pull it gently over so as to fold the foredge extensions over and rub down, one at a time. Turn the corners as indicated in Fig. 211. Paste and fold the foredge turnovers.

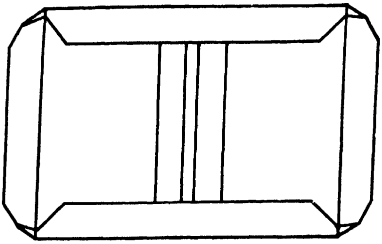

FIG. 211 Case Cover: The Corners Creased and Pasted

Such a case needs a lining or end paper. Examine your schoolbooks and note how the turnovers are covered by an end paper, a sheet of paper which continues on as the last leaf in the book. This is the method used for a sewed book. For a pamphlet or a booklet, a single end paper is used, just large enough to cover the turnovers, coming to within an eighth of an inch of the edge of the case cover. Place this case cover open flat under a weight until thoroughly dry.

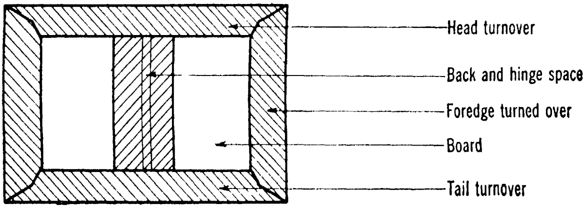

FIG. 212 Case Cover. The Foredge Turnovers Pasted in Place

Using the Gaylord tape, described in Grade III, fasten the booklet or pamphlet into place.

Making a hektograph. Every school should have some kind of device for duplicating. If the school does not possess a mimeograph, a hektograph can be made for a few cents. With this, from fifty to seventy-five impressions can be made from one copy.

Get a pan nine inches by twelve inches and one-half of an inch deep. Get two ounces of gelatine in sheet form and one pint of glycerine. Boil these together slowly in a double boiler for two hours. Pour into the pan, placed so that it is level, and allow to stand overnight to cool thoroughly before using.

To make copy, use hektograph ink on paper with a smooth surface. If it is desired to use typed copy, a hektograph ribbon may be bought for the typewriter. Lay the copy, face down, upon the hektograph, smoothing it with a cloth, and leave it for about two minutes. Remove. To make duplicates, smooth a sheet of paper over the surface and remove immediately, repeating with new sheets until the desired number of copies is made. Always wash off with a sponge or soft cloth and lukewarm water after using.

Desirable outcomes in Grade IV. From this work the teacher may expect:

1. A rather definite notion of the beginnings of the alphabet.
2. Some knowledge of the first famous libraries.
3. Some knowledge of the beginnings of books as developed from scrolls.
4. Some notion of the influence of the environment in suggesting and providing materials to meet needs.
5. Definite knowledge of the correct form for library bibliography cards.

6. An increasing interest in libraries and their conveniences for finding desired information.
7. The beginning of ability to use a library efficiently in reference work.
8. An increasing facility in planning, cutting to measurements, and pasting.
9. A better understanding of book construction.
10. Some ability to make a bibliography.

GRADE V

Clarifying ideas about the paper industry. The fifth grade usually gives much time in geography to the study of the United States. The study of the industrial activities made possible by the physiographic conditions of the various sections should constitute a very vital part of the work. One industry to be found in a number of places is the paper-making industry. This is closely related to the study of lumbering suggested in the chapter on Shelter.

The children can gather information and pictures about paper making by consulting books and magazines. Some paper mills are very generous in sending advertising materials and samples of the " stuff " in its various stages when asked. Visit a paper mill if there is one in your neighborhood. The National Geographic Magazine for March, 1920, pages 234–241, contains some very helpful pictures of the paper-making process.

Make a collection of as many different kinds of paper and cardboard as possible. Make a list of all of the materials the children can find that are used in making paper. Find out why the wood-pulp process was devised. What steps are being taken to provide something to supplement the limited supply of spruce? Why should the governments of the nation and the states attempt to regulate forestry?

Consult some such authority as the World Almanac to find out what countries produce the wood pulp used to-day and what countries manufacture paper. Bulletin Number 758 of the United States Department of Agriculture gives valuable information as to the status of the wood-pulp industries. The Forest Service at Washington will also furnish desirable information on request.

Interest in the processes will probably be such as to raise questions about the beginnings of paper making and hand processes. The Chinese are said to have originated the method. The story can be found in the accounts of the history of the industry, telling of the Mohammedan conquest of a part of western China. Some of these conquerors spent some time at Samarkand but finally returned to their western home. But they went back with what they had not brought — a knowledge of paper making. They had watched the Chinese until they had learned the process. Old linen rags were shredded fine. With these a pulp was made. This was poured on a screen frame held in the water of a brook and shaken gently. When a thin layer of the pulp was spread out smooth, the frame was lifted from the stream and the water drained off. Then the layer of linen pulp was pressed dry into a sheet of paper.

Making paper of linen rags. The simplicity of the process usually stimulates children to make some paper. The following method has proved quite successful as a school enterprise:

Lint or shred old linen rags very fine. Boil them in water containing a little caustic potash or caustic soda to remove gums or other impurities. Wash in clear water. Make a pulp of about the consistency of gravy by adding some starch. If desired, a tint can be secured by putting in a little bluing, red ink, or other coloring material. Make a deckle

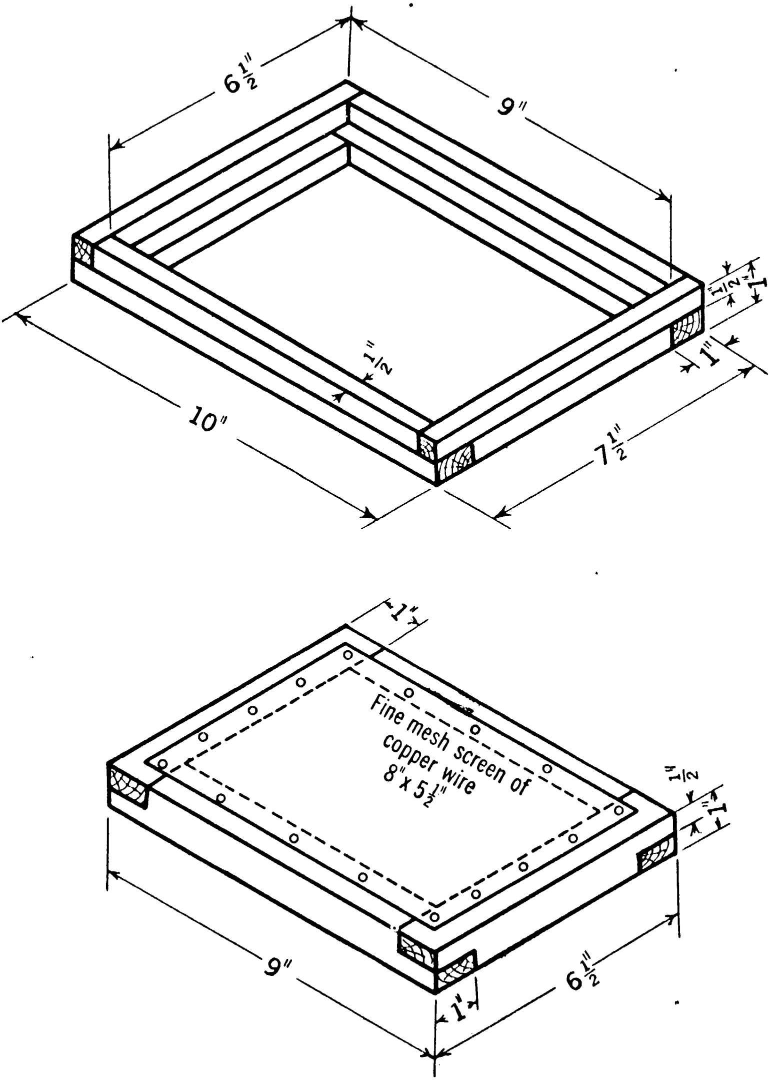

FIG. 213. Working Drawing of a Deckle and Mold

and mold similar to the plan shown in the drawings. The mold is a frame with a fine-mesh, copper-wire screen nailed over it. The deckle is a frame to fit over the mold and keep the pulp from washing off the edges. Fit the deckle on the mold. Pour some pulp on to the mold. When making much paper, the workman dipped the mold and deckle into the pulp. Shake smooth and let the water drain off. Carefully remove the deckle frame. Turn the pulp sheet upon one-half of a piece of cloth twice the size of the mold. Fold the other half of the cloth over the pulp. Both sides of the pulp are now inclosed in the cloth. Run through a clothes wringer. Iron dry with a warm iron.

If care is taken to make the mold and deckle the right size, the resultant paper will make a very attractive Christmas or Easter card when properly decorated and lettered. An interesting and pleasing calendar may also be made of sheets of this paper. Do you now see why certain books and cards are described as made of "deckle-edged" paper?

When the Mohammedans entered Spain, they took with them this knowledge of paper making and the Europeans learned the art from them. We are accustomed to think of these Mohammedans as very undesirable because our histories tell of the efforts of Ferdinand and Isabella to drive them out of Spain, and because of the accounts in Irving's *Conquest of Granada*. There were reasons for driving them from Europe, but to them the Europeans owe the possession of the knowledge of a writing material fitted to the use of the printing press. Without this knowledge, the printing press would not have been the success it was, because of both the difficulty of printing upon parchment and its expensiveness. At the time of the invention of the printing press, there were paper mills in Italy, Spain, and some other parts of southern Europe.

Finding out how early books were made. In the fourth grade, there was suggested the study of scrolls and the change from the rolled scroll to the folded one. In the course of time, after parchment was used as the material for records, the workmen began tying the folded edges along the back together. Later, they slitted the folds along the front, thus making both sides of each sheet available for a writing surface. The curling edges suggested having boards for backs. These were attached to the leaves and the book was tied shut. Later, a clasp was attached to the foredge to hold the book shut.

During the Middle Ages, the monasteries were the seat of learning. The work of the monastery was assigned to members of the monastic orders. Some were the parchment makers, making it by much the same method as that described in Grade III. Others made ink; some made quill pens; and still others did the work of scribes or writers. It was their duty to copy manuscripts all day long. Some books give very interesting accounts of their devotion to this work. You will find it worth while to read the stories in George H. Putnam's *Books and Their Makers*, Vol. I, pages 45–90.

Rivalry between monastic orders and great devotion to the church led to putting forth much effort in beautifying the books. The boards were often covered with leather. This leather was frequently decorated with beautifully tooled designs. Sometimes, precious stones were set in the covers to give greater beauty and value. The scribes also used to adorn the margins of the pages with pen drawings in ink of varied colors.

"And here and there from out the words
A brilliant tropic bird took flight;
And through the margins many a vine

Went wandering — roses, red and white,
Tulip, wind-flower, and columbine
Blossomed." [1]

The initial letters to chapters were often made very ornamental. Thus began what is known as *illuminated* lettering. We find this form of decoration used in motto cards, Christmas cards, Easter cards, or other ornate lettering today. For interesting details about some beautiful books that were made, read all of the poem by Aldrich from which the foregoing quotation is taken, the story of "Gabriel and the Hour Book," by Ebaleen Stein, and Chapter II of Cyril Davenport's *The Book, Its History and Development.* From these sources one will get a vivid picture of the zeal of the scribes. This study may suggest using illuminated lettering on some of the Christmas or Easter cards which the children may make of their paper.

Some of the children may wish to make quill pens and ink. The account in a good encyclopedia is a sufficient guide for making ink as the monks did.

Making a binder for notes. The material gathered about paper making and the history of the book may prove so valuable that it will be worth compiling. In other subjects there may be need for a binder. The loose-leaf binder is quite desirable for the compilation of notes. The following directions are sufficient as a guide in making one.

Use bookbinder's linen and wood-pulp or cloth boards. Eyelets and a punch will be needed. These can often be purchased at bookstores. Some paper is needed for the inside of the binder as single end papers.

Plan the book to fit the punched paper, which can be bought at the stores. A No. 4 paper is a convenient size.

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[1] Aldrich, Thomas Bailey. — *Friar Jerome's Beautiful Book.*

Make the boards for the binder large enough to extend one-fourth inch beyond the paper at the head and tail. To make it flexible enough to open when the paper is tied in, a hinge should be provided near the back. Therefore, cut the board for each cover in two pieces, the smaller one 1″ wide and as long as the binder is to be. Leave ¼″ hinge space between this strip and the larger board. The larger board should be as long as the smaller and one inch narrower than the paper. Cut the linen so that it is large enough to extend ¾″ beyond the boards on all sides when they are placed in position, allowing the space, ¼″ wide, between the boards.

Follow the directions for pasting on page 372, reinforcing the hinge with manila paper, making corners, and pasting turnovers given in Grade IV, page 378. Cut the single end paper, or lining paper, large enough to come within an eighth of an inch of all of the edges of the binder. Paste in position. Place under a weight to dry. Mark the places for the eyelets and set them. Fasten the binder together with rings or a shoe string.

Learning how to make a right angle. In cutting paper and linen, there is always the difficulty of cutting the corners so that they are right-angled. Try squares are not always available. A very easy way to make a right angle is to fold a piece of paper making a straight fold. Fold a second time at right angles to the first fold. This is done when the part of the folded edge folded over lies exactly above the part of the folded edge below it, the two edges being just even. This pattern may then be used to square the corners of paper or linen before cutting.

Continuing the bibliography. It is desirable to encourage the children to be methodical in their investigations and reading. The range and the amount of reference work and investigating are increasing as they grow older. It will be well to continue the bibliographies begun in the fourth grade.

Desirable outcomes in Grade V. From this work the teacher may expect:

1. Rather definite knowledge of the paper-making industry, the fundamentals of the process, the materials generally used, and some of the kinds of paper available.
2. An interest in the history of paper making, and of the handmade book.
3. An ability in all-over pasting and book construction sufficient to make some desirable products.
4. Some ability to plan, estimate amounts, and cut to dimensions with paper and cardboard.
5. An increasing interest in books, their bindings, and how to care for them.
6. A growing ability to investigate, use reference books, and keep records of data found by means of bibliographies and notebooks.

GRADE VI

Finding what changes the invention of printing produced. One of the results of the Crusades was to make people aware of what other people did. In this way it is quite probable that the knowledge of paper making was spread. There followed a period of much travel and investigation. One line of activity culminated in the invention of a printing press. Block printing was an art which had long been perfected in the Orient. Travelers from the West found that the Chinese and Japanese were makers of wonderful books. Their skill in block printing thus became known to Europe. There are many interesting stories about the invention of printing that followed. At times there have been heated controversies as to who invented this process. Some argued that it was Gutenberg, others that it was

Coster. Browning wrote a beautiful poem called "Fust and His Friends." In this poem he represents Fust as the inventor and gives a dramatic picture of how the invention was made known to others. After children have learned the main facts about the invention and the times, they will find this poem an interesting account. Some children have found much pleasure in dramatizing it. It helps to give one a vivid impression of how such a remarkable invention was received. Excellent material for further reading about the invention will be found in *The Book, Its History and Development*, by Cyril Davenport.

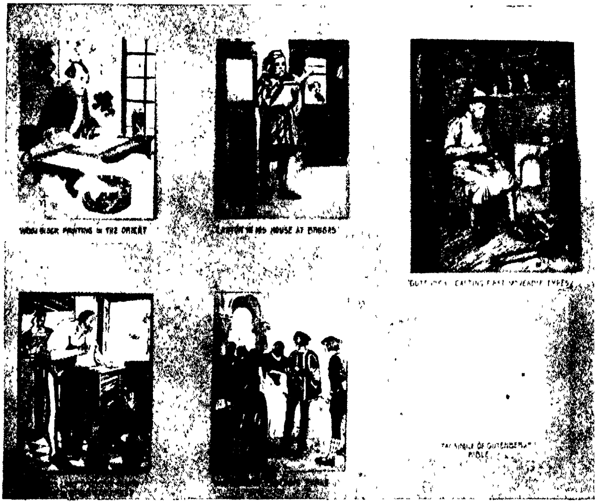
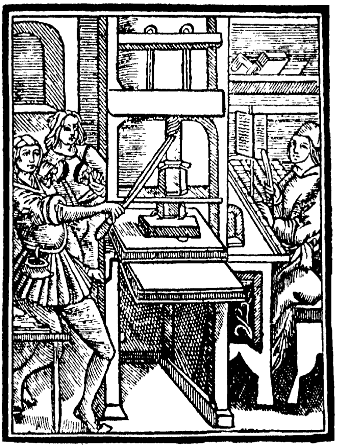

WOOD BLOCK PRINTING IN THE ORIENT
CAXTON IN HIS HOUSE AT BRUGES
GUTENBERG CASTING FIRST MOVEABLE TYPES
FACSIMILE OF GUTENBERG'S BIBLE

FIG. 214. A Chart Made to Summarize the Story of the Invention of Printing

The results of the invention upon the prevalence of books and the ease with which new ideas were scattered among people may be found by reading the histories of those times. It will be recalled that American histories often mention Marco Polo's being an indirect cause of Columbus' discovery of America because of the wonderful stories he brought back about the things he had seen in the East. These tempted people to try to find an easier way to go to the East. But the histories usually fail to tell what those wonderful stories were, or how the stories were made known all over Europe. With conditions as they were when books were painstakingly copied by hand, knowledge would not be scattered very rapidly by books. It was due to this invention of printing that enough books could be made about the travels of Marco Polo and others to thrill men with the idea of sailing unknown, dangerous seas to find this new route. Read the accounts of the influence of the Crusades, the travels of Marco Polo, the invention of printing, the lives of Coster, Gutenberg, Fust, Caxton, and others to get a full impression of the changes that resulted from the invention of printing.

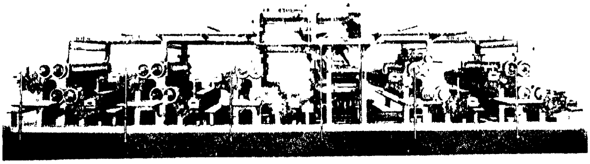


Courtesy R. Hoe & Co.

FIG. 215 The Earliest Form of Printing Press

Tracing the improvements made in the printing press. The first printing presses were very crude affairs, as can be seen by looking at pictures of them. Benjamin Franklin was the first noted printer in this country. Find pictures of the Franklin press and see how crude it was. Visit a local printing office and see how complex and efficient a modern press is as compared with a Franklin press. If possible, visit a printing establishment which contains a modern Hoe press used to turn out the great daily newspapers.

Using a printing press. Compare the hand type-setting with the work of the linotype and monotype machines for setting type. Compare job press work with the work of the huge modern press for newspapers and books. If there is a school printing press, visit it and gain permission to try setting type in printing some invitations, announcements, or programs. It may be possible to have the use of the press at regular intervals with time enough to issue a small class paper. Some such experience is very desirable in giving one a real appreciation of what printing is.



Courtesy R. Hoe & Co., New York City

FIG. 216 Twentieth Century Superspeed Decuple Press

This press has a capacity of 80,000 papers per hour, of four to twenty pages. The paper rolls are below the pressroom floor.

How important is the printing press? How much time do you consume in using its products? In the following quotation does the printing press claim too much for itself?

I AM THE PRINTING PRESS

Written by ROBERT H DAVIS
for R. Hoe & Co.

I AM the printing press, born of the mother earth. My heart is of steel, my limbs are of iron, and my fingers are of brass.

I sing the songs of the world, the oratorios of history, the symphonies of all time.

I am the voice of to-day, the herald of to-morrow. I weave into the warp of the past the woof of the future. I tell the stories of peace and war alike.

I make the human heart beat with passion or tenderness. I stir the pulse of nations, and make brave men do braver deeds, and soldiers die.

I inspire the midnight toiler, weary at his loom, to lift his head again and gaze, with fearlessness, into the vast beyond, seeking the consolation of a hope eternal.

When I speak a myriad people listen to my voice. The Anglo-Saxon, the Celt, the Hun, the Slav, the Hindu, all comprehend me.

I am the tireless clarion of the news. I cry your joys and sorrows every hour. I fill the dullard's mind with thoughts uplifting. I am light, knowledge, and power. I epitomize the conquests of mind over matter.

I am the record of all things mankind has achieved. My offspring comes to you in the candle's glow, amid the dim lamps of poverty, the splendor of riches; at sunrise, at high noon, and in the waning evening.

I am the laughter and tears of the world, and I shall never die until all things return to the immutable dust.

I am the printing press.

By permission of R. Hoe and Co.

Finding out how books and magazines are illustrated. The study of illuminated lettering in the fifth grade revealed the hand process of making books beautiful. The trip to the printing press and discussions following should raise questions as to how pictures and illustrations are made.

Borrow a compound microscope from the science laboratory and place the colored picture on the cover of a magazine under the lens. Move the different colors into the field and note the small spots of various colors which make up a given color. The children will be much surprised at what they see and will ask many questions of how and why. A letter of request to a company which prints a magazine having colored pictures may get samples showing the successive imprints which make the final color.

There are three plates — four if black is used in the picture. One prints yellow, one blue, and one red. The first impression may be yellow. Red may follow. Where it comes close to the yellow, orange color appears. So, the second impression is part yellow, part red, and part orange. Then blue is added. This, when close to red, makes purple appear; when close to yellow, green; and, when close to red and yellow, makes various shades of brown according to the amount of red and yellow and blue used. Any one of these plates makes only a part of the picture. All three have to be used before the picture is complete.

The way in which these plates are secured is interesting. The original picture in color is photographed three times by the camera. At one time, a lens is used which permits only the red of the picture to be photographed. At another, a lens is used that permits only the blue to be photographed. And yet another lens photographs only the yellow. The plates are made from these photographs.

The children may also become interested in investigating the processes of steel engraving, zinc etching, copper plating, stereotyping, lithographing, and making cuts of cartoons. Compare the results of these processes with the results when block printing and wood cuts were used. Perhaps some one in the community will lend the class an old book illustrated with wood cuts. See what the children can find out about wood cuts.

Compare with these various processes in printing papers and books, the processes used in decorating textiles. Methods of stenciling, calico printing, and batik work will show similarities in processes and the application of principles.

Finding out about other modern methods of writing and communicating. Make a list of devices and methods of writing and communicating other than by the use of printing. This will include the typewriter, the mimeograph, the telegraph, and the phonograph as among the more important forms. The modified forms of alphabets as used in telegraphy and shorthand will be of interest in this connection. Modern forms of efficient pencils and pens will also form an interesting contrast with ancient writing materials.

Finding out how a sewed book is made. By this time the children will probably be interested in seeing how a sewed book is made. Interest may be stimulated by examining old books which are coming apart. Call attention to the double end papers; to the fact that the end paper is pasted to the leaf next to it; and to the facts that the leaves are in groups or signatures, that these signatures are sewed together along the back, and that some cloth called *super*, somewhat like cheesecloth, is placed along the back and extends under the end papers. If possible, get an old hand-sewed book and a machine-sewed book, and compare them. Note the knots to be found occasionally on the inside of the signatures. See whether the children can discover the procedure in sewing by hand. Note that tapes, or cords, are used in the hand-sewed book around which the thread passes. Trace these tapes or cords into the case covers.

See if the children can tell the purpose of the super. Note how the cloth along the back of the book in reinforced with stiff paper. Why? See if the children can tell why the end paper and the leaf next to it are pasted together. Get an uncut pamphlet or magazine, preferably octavo fold. Take out the first signature. Unfold it and see if the children can discover the correct way of folding a sheet into an octavo signature.

Making a sewed book. Before reaching this grade, the children will have been taught all-over pasting, estimating, planning, and cutting materials, and making a case cover. They will easily recognize these steps as integral in the making of the books they have examined, and they will be able to see what they do not know how to do. The following directions will aid in teaching them the correct way of folding the signatures, sewing the book, and putting it into the case cover.

1. *Folding the paper.* Four signatures are enough for a child to undertake in making his first book. For this he needs four sheets of paper. Be sure to use tough paper with beginners. Each sheet is folded into an octavo-fold signature as follows:

a. Stack the four sheets, laying them on the desk so that one long edge is even and parallel with the edge of the desk toward you.

b. Fold the top sheet over from right to left so that the edges exactly meet.

c. Fold the edge away from you over to the edge next you so that the edges exactly meet.

d. Fold again from right to left making edges exactly meet.

Number the pages of this signature. Page 1 has a folded edge to the left and at the top, or *head*, of it, a raw edge at the front, or *foredge*, and at the bottom, or *tail*. When you have the sixteen pages numbered, open and check with Fig. 217. Fold the other three signatures in the same way and number the pages in the proper sequence.

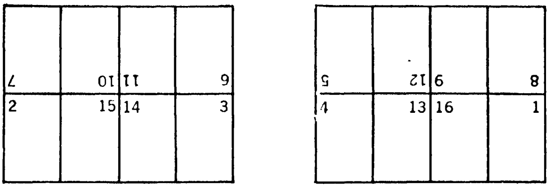


FIG. 217 Showing the Paging of an Octavo-Fold Section

A book is named, as to size, by the number of pages *on one side* into which the sheet is folded. Hence, this is an *octavo* fold. Other sizes frequently spoken of are: folio, two pages; quarto, four pages; and duodecimo, twelve pages. In *The Book, Its History and Development*, by Davenport, Chapter II, the history of folding will be found. The parts of a book, as given in the foregoing, are given in Fig. 218.

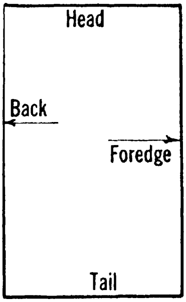


FIG. 218. Parts of the Book

2. *Preparing the signatures for sewing.* Assemble, or *collate*, the four signatures in correct number sequence. Take the collated book between the ends of the fingers of the two hands with the back down, head away from you, tail toward you, and foredge up. Knock the back on the desk gently until the folded back edges of the signatures are even. Turn the head down. Knock on the desk to make even. Turn the book on to the fingers of the left hand so that the head is to the right, back toward you, tail to the left, and foredge away

from you. Slip the right hand under the head carefully, not permitting the signatures to slip on each other, and gently drop on the desk, parallel to the edge next to you.

Mark the back of the book on each signature to show where the tapes and kettle stitch go, thus:

For the tapes: The length of the book is the distance from head to tail. Take a strip of paper the length of the book. Fold into quarters. Lay along the back of the top signature. Mark at the places designated by the creases in the strip of paper. Each space is called a *panel*. Beginning at the tail, mark above each panel a distance equal to the width of the tape.

Of the several panels, this will make the lower, or tail panel, the widest, and the head panel the narrowest. Do not crowd the tapes in marking. Fold a sheet of paper at right angles to one of its straight edges. This is needed in marking the other signatures. They may have slipped, so it is well to knock up the book again. Do this as before, beginning by taking the collated book between the ends of the fingers of the two hands, and proceeding as directed in the foregoing. When the signatures are exactly in place, with heads to the right, backs toward you, and backs and heads even, lay the folded piece of paper at one mark so that the fold lies exactly along the back of the top signature. One-half of the edge of the paper now hangs down crossing the backs of the signatures. Draw a line down along the edge. This places a mark on the back of each signature, the four marks being equidistant from the head. In the same way carry all division marks down on to the other signatures.

For kettle-stitch marks: Measure off one-half inch from the head and from the tail and place a mark at each point on the top signature. Use the folded paper to carry the marks down to the other signatures. Knock up the book and lay so that the back extends over the edge of the table one-fourth of an inch, heads to the right. Using a back saw, with a downward stroke only, saw the kettle-stitch grooves one-sixteenth of an inch deep. If preferred, these grooves may be snipped with scissors, and then "sawed" with the blade of the scissors.

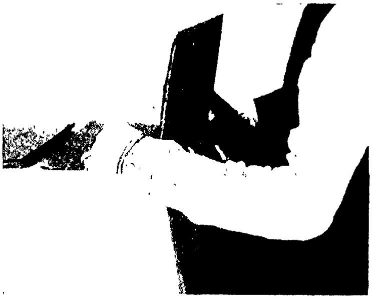


Fig. 219 Sewing without a Frame
Note the correct position of the hands and the correct placing of the unsewed sections

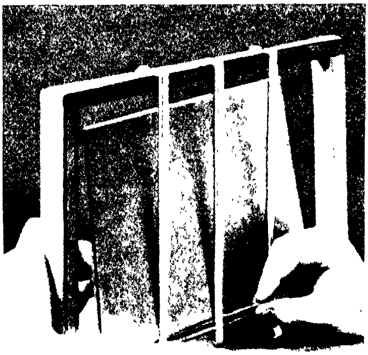


Fig. 220. Sewing with a Frame
Frames are desirable when there are many sections to be sewed.

3. *Sewing the book.* *a.* Lay the book, in correct order of signatures, so that the back is toward you, head to the right, and the last signature on top of the pile.

b. Turn all of the signatures over away from you so that the head is to the right, the back away from you, and page 1 up.

c. Turn the first signature back toward you, in position as in *a*.

d. Without lifting from the desk, open the signature to the middle, bending the under half so that the fold is easily accessible. Keep all work on the desk. Lifting a signature may lead to sewing it in wrong end up.

e. Prick holes at the tape pencil marks.

f. Thread the needle, making no knot.

g. With the needle in the right hand, enter the book from the back at the head kettle-stitch hole. Put the left hand inside and pull the needle through, leaving about three inches of thread hanging outside. Keep the left hand inside and the right hand outside throughout the sewing.

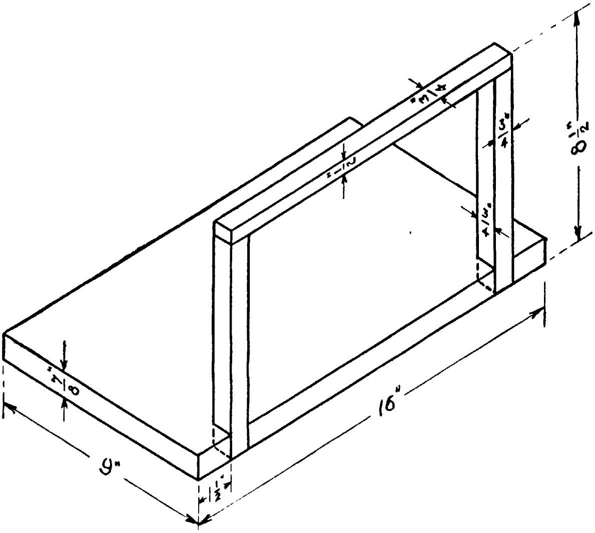


FIG. 221. Working Drawing for Making a Sewing Frame

h. Sew through and out at the tail kettle stitch.

i. Cut three tapes, four inches long. Insert the tapes in their places along the back. Tighten the thread.

j. Turn the lower half of each tape under the book.

k. Turn over the second signature so that it lies on the first with the head to the right, the back along the edge of the table. Keep in place, open, and prick at the tape marks.

l. Enter the needle at the tail kettle-stitch hole and sew through, bringing the needle out at the head kettle stitch. Pass the thread around the tapes so that they are in their places.

m. Tighten the thread, pulling in the direction the thread has been traveling. If pulled in the opposite direction, the paper will tear.

n. Tie the thread to the end left hanging at *g*, using a square knot.

o. Put on the third signature and prick.

p. Enter the head kettle-stitch hole, sew through, and come out at the tail kettle stitch. Tighten.

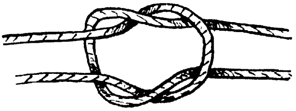


FIG. 222 Diagram of a Square Knot

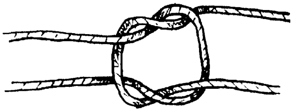


FIG. 223 Diagram of a Granny Knot
Note how the square knot differs from this knot.

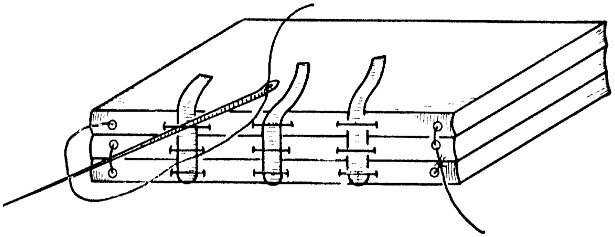


FIG. 224. Showing the Method of Making the Kettle Stitch

q. Make a kettle stitch as shown in Fig. 224. This fastens the third signature to the second at the tail.

r. Put on the fourth signature, prick, sew, tighten, and make the kettle stitch. Since this ends the sewing, a second kettle stitch is needed to fasten the thread. This stitch should reach down to include one lower signature.

s. Cut the threads to one-half inch in length. Do not tie.

4. *Tying a new thread in sewing.* One thread is not sufficient for sewing a four-section book unless the book is very small. Always tie between tapes so that the knot can be drawn to the inside to avoid roughness on the back of the book. To tie: Hold the needle in the last three fingers of the right hand. Hold the end of the new thread in the left hand. With the thumb and first finger of the right hand, throw a loop of the new thread *behind* the thread in the left hand. Place this loop on the old thread about one inch from the book, or a distance equal to half the distance between the tapes. Take up with the needle the old thread through the loop of the new thread. Pull up, making sure that the old thread snaps up into the loop. Pull the knot to the inside of the section.

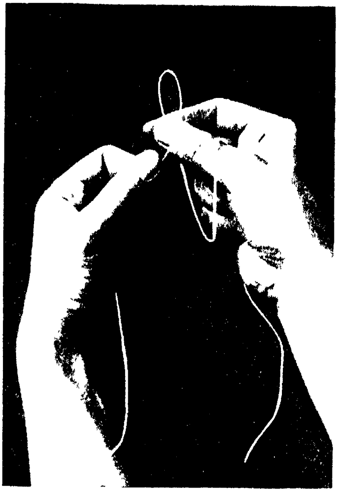


FIG. 225. Position of the Hands in Making the Loop When Tying a Knot

5. *Gluing the book.* Tighten the tapes. Knock up the book so that the back and head are square. Put glue along the back so that it fills the cracks between the signatures.

Flexible glue is preferable, but common glue will do for a thin book. Dry under a moderate weight, being sure that the tapes are all in place.

6. *Cutting the pieces for the case cover.* To make the case cover, follow the directions for all-over pasting, cutting corners, pasting down turnovers and corners, and pressing as given in foregoing grades.

a. Cut the two boards needed, one-fourth of an inch longer than the sewed book, and exactly as wide as it is.

b. If the cover is to be of cloth and paper combined, cut the pieces as indicated in Fig. 227. The strip of cloth, or bookbinder's linen, is made a width equal to the thickness of the book, plus two one-quarter-inch hinge spaces, plus two one-inch spaces. It is one and one-half inches longer than the boards to allow for turnovers three-fourths of an inch wide at each end.

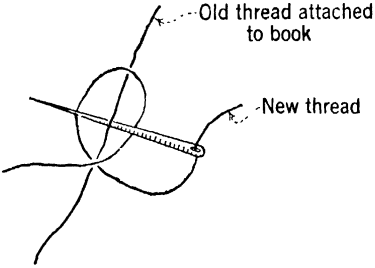


FIG. 226. The Knot Ready to Draw Up

c. The pieces of cover paper are as long as the book linen and as wide as the boards.

d. A piece of stiff manila paper, as wide as the book is thick and as long as the boards, is cut to strengthen the cloth along the back.

7. *Making the case cover.* Draw, on the wrong side of the linen, lines showing the places where the boards are to be pasted, as in Fig. 208, and where the stiff manila is to be pasted. Put paste upon the linen where the boards are to

be placed. Put the boards in place and press firmly. Do the same with the stiff manila strip. Turn the work over, cover with a clean piece of newspaper, and rub smooth. Turn over head and tail margins of linen and crease carefully in the hinge spaces. See page 379. Draw, with the edge of the bone folder, a line one-eighth of an inch from each edge of the linen on the right side, to serve as guides in placing the cover paper. Put paste on the cover paper. Lifting by two corners, apply on one board so that a long edge meets

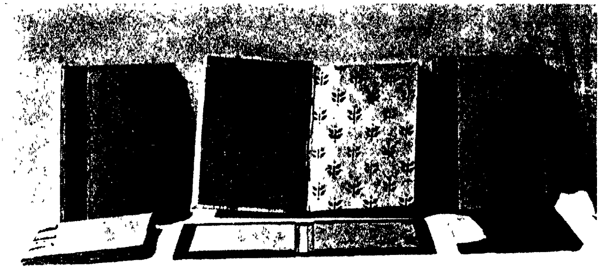


FIG. 227. The Book Sewed, End Sheets and Super Attached, the Case Cover, the Wood-Blocked End Sheets, and the Finished Books

the line just drawn with the bone folder. Cover with clean paper and rub smooth with the edge of the bone folder. Similarly paste the cover paper on the other board. Clip the corners as indicated in Fig. 209. Paste down first the head and tail turnovers, then the corner creases, then the foredge turnovers. Place under a weight to dry.

8. *Preparing the sewed book for the case cover.* Cut two end papers, as long as the book is long and twice as wide as the book. Fold each so that the folded end paper just fits the size of the book. Carefully fold the tapes out of the way.

Apply paste along the last leaf of the book, covering a strip one-fourth inch wide next to the back of the book. Put an end paper in place and press down on the pasted portion. Do the same for the other end paper. Cut the tapes to a uniform length, about one inch or a little more. Paste them down on the end papers. Cut a strip of thin cloth as long as the book and three inches wide. Spread paste on the back of the book and along each end paper over a strip next to the back a little over an inch wide. Apply the cloth to this pasted area. Rub smooth. Dry the book. It is now ready for the case cover.

FIG. 228. A Sixth-Grade Class Finishing Their Books

9. *Putting the book in the case cover.* Fit the book into the case cover, seeing that the cover extends beyond the

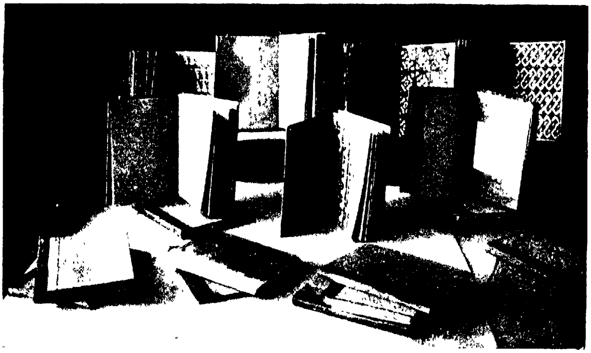


FIG. 229 Showing Varieties of Design in End Sheets

FIG. 230. Wood Blocks Made by Children for Book Plates and End Sheets

book uniformly. Push the book well back into the case cover. Crease the hinge spaces. Place the book on the table with the back toward you. Raise the upper half of the cover and insert a clean piece of newspaper between the two leaves of the top end paper. Be careful not to let the book slip from its position in the cover. Drop the upper half of the end paper to the newspaper. Place paste all over the exposed end paper. Replace the soiled piece of newspaper with a clean piece. Drop the lid to place. Press firmly. Turn the book over. Open carefully to the newspaper. Rub the pasted end paper down smooth. Close the book. Open the top cover. Insert a newspaper between the two leaves of the second end paper. Paste. Replace the soiled piece of newspaper with a clean piece. Drop the cover. Press. Turn over. Open to the second newspaper sheet and rub as before. See that the hinge is properly rubbed smooth. Place the book between clean papers under a weight to dry.

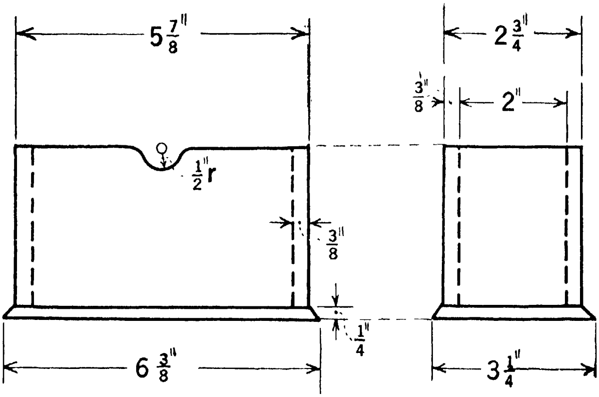


FIG. 231 Working Drawing of a Bibliography Case of Wood

The end papers and cover design of the book may be "wood-blocked." Linoleum may be substituted for wood in cutting the block. Visit the bookstore or library and note the motifs used for end-paper designs and the way in which they express the theme of the book.

Applying knowledge of book construction to the repair of books. Visit the library and ask the librarian how she repairs books. Read any book she may have on the subject. Use the knowledge the children have of book construction. Encourage a spirit of caring for books, and of repairing them when injured. *Book Binding and the Care of Books,* by Douglas Cockerell, will aid in this work.

Making a bibliography case of wood. To continue the keeping of a bibliography of books read and of references

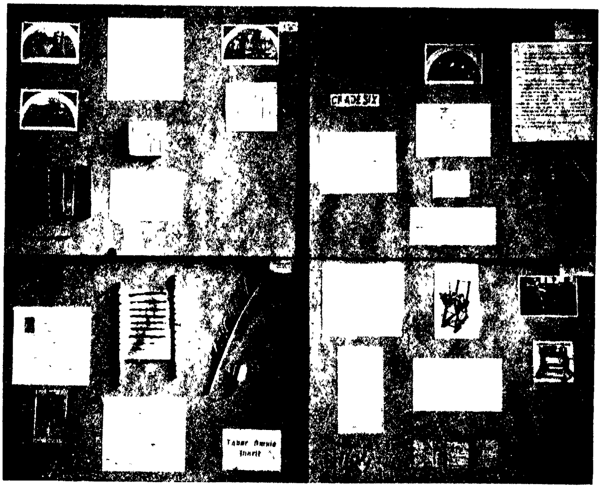


Fig. 232 A Summary Made by One Class, of the History of Records

found valuable, a new case, and perhaps a larger one, will be needed. Basswood, one-quarter of an inch thick, is easily worked. If sufficient equipment is available, a harder wood can be used. See the case made of wood in Fig. 207. The working drawing in Fig. 231 will suggest the construction.

Desirable outcomes in Grade VI. From this work, the teacher may expect:

1. Rather definite knowledge of the history of the book and of the invention and improvement of the art of printing and the printing press.

2. A general understanding of the processes involved in printing.

3. An interest in processes of illustration and some understanding of them.

4. A clear idea of the processes of bookbinding.

5. An increased understanding of woodworking construction by making a bibliography case.

6. A general interest in the form and appearance of books, and an attitude making for their proper care.

BIBLIOGRAPHY

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Includes the history of papyrus, parchment, and paper, and the modern methods of paper making, including watermarks and varieties of paper.

CLODD, EDWARD. — *Story of the Alphabet.* Appleton.

Contains the history of the alphabet, cuneiform writing, Egyptian hieroglyphics, Cretan, Chinese, Japanese, and Korean writing, and the papyri of Greece.

COCKERELL, DOUGLAS. — *Bookbinding and the Care of Books.* Appleton.

Very detailed description of processes. An excellent guide for all phases of hand bookbinding.

DAVENPORT, CYRIL. — *The Book, Its History and Development.* Van Nostrand.

A detailed history of processes in making papyrus, parchment, paper, and books. Well illustrated.

HARDING, SAMUEL BANNISTER. — *Story of the Middle Ages.* Scott, Foresman.

Chapter 16. Life in a Monastery. Describes the work of the scribe. Suitable for use of children of the fifth and sixth grades.

JOHNSTON, EDWARD. — *Writing and Illuminating and Lettering.* Macmillan.

Contains the development of writing, tools, and materials for manuscript books, inlaying, use of gold, theory of illumination, and various alphabets.

PUTNAM, GEORGE H. — *Books and Their Makers during the Middle Ages.* 2 vols. Putnam.

A compilation of very interesting details pertaining to bookmaking in the Middle Ages.

RAWLINGS, GERTRUDE. — *The Story of Books.* Appleton.

A detailed history of bookmaking in the Middle Ages, the invention of printing, early activities in printing, and a brief account of modern bookmaking.

SMITH, ADÈLE MILLICENT. — *Printing and Writing Materials: Their Evolution.* Published by the author. Avil Paper Co., Philadelphia.

History of printing, including ancient relief processes, block printing, invention of typography, early printing presses, reproductive processes, and writing materials, including rocks, wood, leather tablets, wax tablets, bark, skins, papyrus, and paper.

STEIN, EBALEEN. — *Gabriel and the Hour Book.* Page Co., Boston.

A story of a boy in the days of making books by the monks in the monastery. Suitable for fifth-grade age.

WINSLOW, LEON L. — *Elementary Industrial Arts.* Macmillan.

Chapters 1 and 2 are on bookmaking and paper making, treating of both the historical development and modern processes.

CHAPTER XII

SUGGESTIONS FOR THE STUDY OF TOOLS AND MACHINES

Studying tools and machines in relationship to their uses. The interest in tools and machines is largely connected with the processes and purposes for which tools and machines are used. Most of these purposes are related to the means by which we are provided with food, shelter, clothing, utensils, and records. There are, however, some other uses for these devices. Musical instruments, clocks and watches, vehicles for transportation on land, on water, and in the air, and the equipment for some games and sports are among the most important of those not included by the five industrial fields covered in foregoing chapters.

The study of these tools and machines is best taken up as the uses are found in the respective fields — tools and machines having to do with the production and preparation of foods in connection with appropriate units in foods; those having to do with clothing as parts of clothing units; and so on. Tools and machines not included within these five fields should be taken up as their uses become important parts of other studies — musical instruments in music study, vehicles in connection with industrial and commercial geography or history, in which transportation is an important element, and so on, each study of tools or implements growing out of a natural setting which gives it purpose and meaning.

Placing the emphasis. The points to emphasize in the study of tools and machines are these: How the tool or machine does its work; how it is properly used and cared for; *the advantage that comes from its use; and the changes brought about in human life by its invention.* In some cases, it will be of interest to children to make some tools and simple machines, and such work in construction will help to make clear the operation and care of these tools or machines. But, for most of these devices, construction is neither possible nor desirable. The most important elements to bring out are the values of the tools and implements to man and their proper use and care. Every opportunity should be used to teach children to avoid accidents in using tools and in observing the work of machines.

Wherever any tool or machine considered in these pages is studied, it should be taken up after its use has been noted in connection with some setting which gives motive for it. Wherever a principle of physical or biological science is easily seen in operation, one should call attention to it, making as clear as possible the method of its behavior. Two or three good elementary textbooks on general science should be available to the children, and they should be encouraged to use them.

GRADE I

Noting the tools used in school. In the first grade, the tools used in other units of study will include knives, forks, spoons, nutcrackers, and nut picks in connection with foods; the scissors, needle, thimble, and ruler or tapeline in connection with clothing work; the pencil, ruler, scissors, paste brush, and paint brush in making utensils of paper or cardboard, and in making booklets, posters, announcements, gift cards, and wall papers; and the ruler, saw, try square, and hammer in making the house and furnishings. A very simple loom may also be made for weaving a rug for the house. As each of these tools is taken up, its appropriateness may be considered, and, as needs are noted by the teacher, brief discussions may be had on proper usage and care. Good habits of using tools should be developed from the beginning, but it should be remembered that skill in such usage cannot all come at once.

Discussing uses of tools in the home and community. In the discussions about life at home and in the neighborhood, frequent references will be made to tools and machines used in the home, in gardens, in games, and in the work of the community. It is worth while to lead the children to see how prominent is the use of tools and machines in our daily lives. Leading the children to name all of the cutting tools they can think of, all of the kinds of vehicles used, all of the devices for keeping house, all of the tools or other devices for writing, and so on, will help to direct attention to tools and implements and bring some appreciation of how dependent we are upon them. The interest in toy tools and machines may be strong, and possessions at home may be talked about or collections made at school.

Desirable outcomes in Grade I. From this work the teacher may expect:

1. A consciousness of the most familiar tools used in construction work, and beginnings in the development of dexterity in handling these.
2. A beginning of knowledge of the proper usage and care of tools.
3. An enlarged interest in the tools and machines used in the home and the community.
4. A beginning of the realization of the importance of tools and machines in our everyday lives.

GRADE II

Using new tools in school work. More extended use of the tools already familiar will be made in this grade, and a number will be added. The washboard, ironing board, and flatiron will be used in the laundering of clothes; and the broom will be used in housekeeping. Mention may be made of the washing machine, the wringer, the mop, the carpet sweeper, and the vacuum cleaner as devices for laundering and housekeeping. In making furniture, the brace and bit, the screw driver, and perhaps the plane may be new tools used. The hatchet and the ax as cutting and splitting tools will probably be mentioned. The more common woodworking tools and power machines found in use in lumbering as brought out by the making of a sandtable lumber camp may be noted.

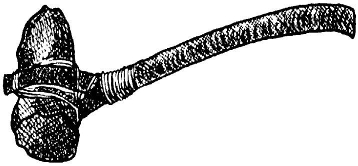


FIG. 233. A Stone Hammer

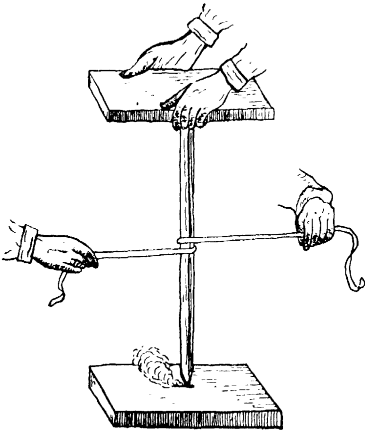


FIG. 234. A Strap Drill

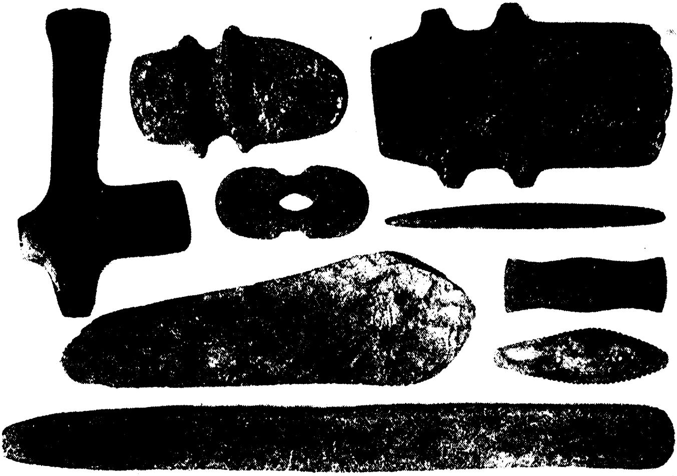
Finding what tools primitive man used. In the study of primitive life, stone hammers, wooden or bone awls, needles and boring drills, fire drills, digging sticks, throwing sticks, traps and snares, spears, bows and arrows, tools for dressing skins, boats, sleds, and carts will be mentioned. Most of these can be made in simple form by the children in connection with programs, dramatizations, or summarized organizations of work. If the work is supplemented by the use of such books as the Dopp series, much interest will probably develop in primitive tools, and most children will wish to make some of them. If American pioneer life is studied also in this grade, some of the tools and machines here found will be of interest. Present-day tools and methods of work should be contrasted with those of these earlier periods — the fire drill with our use of matches, stick and bone needles and stone hammers and knives with our metal tools, and primitive and pioneer vehicles with our modern sleds, boats, and wagons.

Desirable outcomes in Grade II. From this work, the teacher may expect:

1. A gradually increasing facility in the use of tools.
2. An enlarging sense of the extent to which tools are used in accomplishing work.
3. Some acquaintance with the tools of primitive and pioneer peoples, and with the limitations of life without our modern tools and machines.

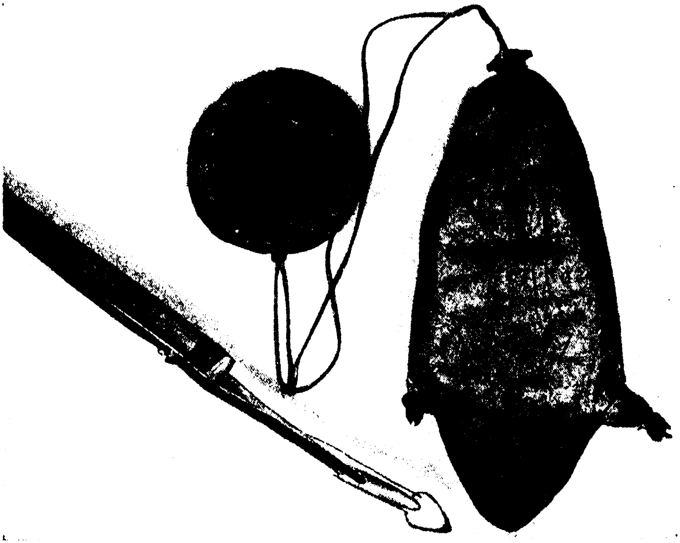
GRADE III

Finding how tools and machines help in producing foods. In the food studies of this year, the implements introduced will include the churn for making butter; mills and grinders for grinding grains, coffee, and meats; sieves for sifting flour and meals; apple peelers; and egg beaters. Atten-



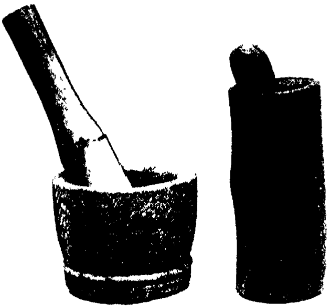
Courtesy American Museum of Natural History

FIG. 235. Stone Implements Found in Tennessee



Courtesy American Museum of Natural History

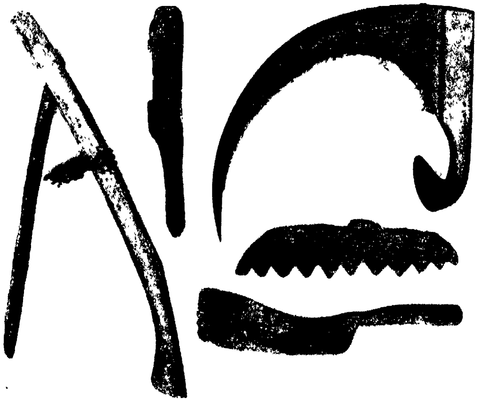
FIG. 236. Harpoon and Float Used by the Eskimo of Baffin Land



Courtesy Metropolitan Museum of Art

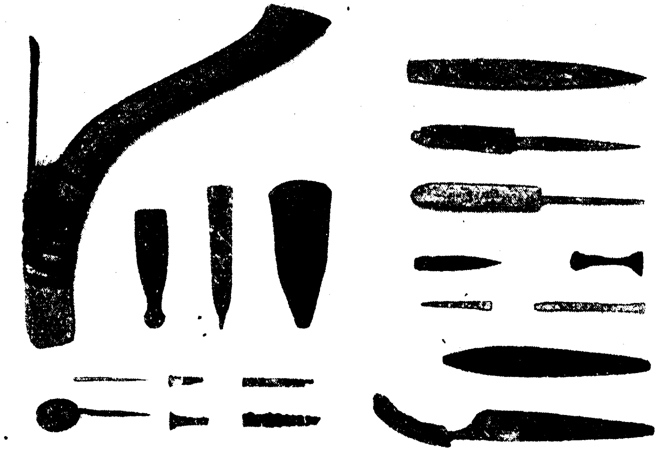
FIG 237 Two Types of Mortar and Pestle

tion should be called to the ways in which these operate. In the study of early peoples, the Indians and Hebrews, there will be found the use of knives of stone, bone, and metal, fishhooks, fish and animal nets, traps, and snares, the sling for throwing stones in hunting, the mortar and pestle, the hand mill and the treadmill for grinding grains, the flail for threshing grains, simple forms of plows and



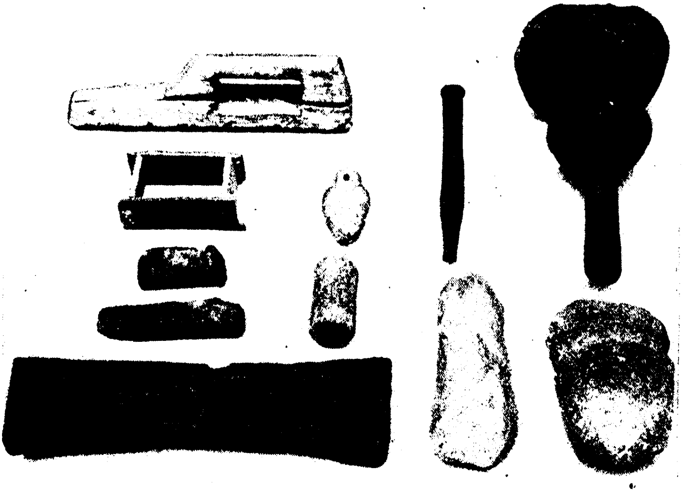
Courtesy Metropolitan Museum of Art

FIG 238 Ancient Egyptian Agricultural Tools of Wood
Hoe, winnowing scoop, saber head, and sickle with flint blade.



Courtesy Metropolitan Museum of Art

FIG. 239. Bronze Carpenter's Tools from Ancient Egypt, Including Saws, Chisels, and Awls



Courtesy Metropolitan Museum of Art

FIG. 240. Carpenter's Tools of Wood and Stone from Ancient Egypt

hoes for cultivating the land, and several forms of knives and sickles for harvesting grains. Present-day sickles, scythes, corn knives, and grain cradles should be noted in connection with primitive harvesting tools. A simple form of the balance for weighing will be found. Presses will also be found for pressing oil from olives and wine from grapes. Contrasts should be made between the slow, laborious use of most of these primitive tools and machines, and the rapid, efficient machines of to-day driven by power. In the study of American colonial life, numerous tools and machines will be found in use, many inferior to those of to-day, yet far advanced over those of the more primitive peoples or of the ancient peoples.

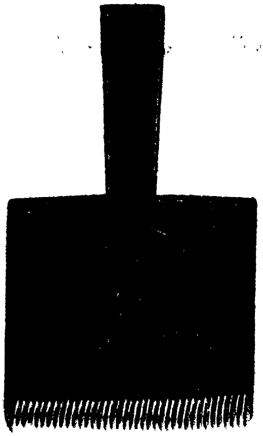
Courtesy American Museum of Natural History

FIG. 241. Menomonie Indian Canoes

Making a loom, and learning of new textile tools. In the clothing studies, a loom with a heddle device for separating the threads in weaving may be made, showing a marked improvement over the earlier, more simple looms.

Shears for shearing the wool from sheep will be found in use by early peoples. Combs and cards for untangling and straightening the wool fibers may be used in preparing wool for spinning.

Making windmills and water wheels. References will be found to the use of water power in pumping water for irrigation purposes, and in driving grain mills and sawmills. The wind as a driving power for sailboats and mills may also be noted. Simple forms of water wheels and windmills may be made to illustrate the use of water and wind for driving machinery.

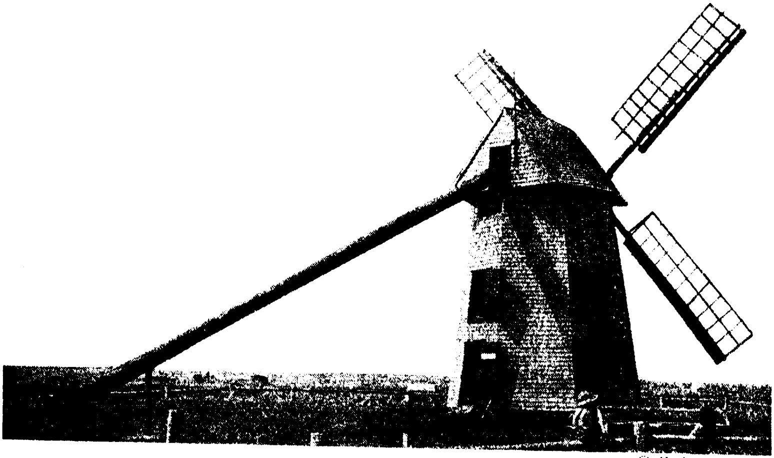


Courtesy Metropolitan Museum of Art

FIG. 242. An Ancient Egyptian Comb for Carding Wool

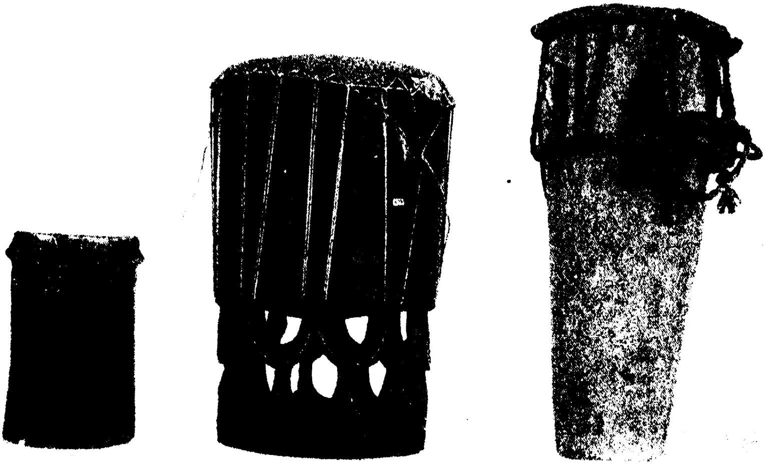
Making simple musical instruments. Some simple musical instruments will be found in use by early peoples, and children may profitably experiment in making whistles, pipes, simple stringed instruments, and drums or instruments made of wood or metal yielding tones when struck by a stick or a hammer. The marimba forms of primitive peoples are easily made. Such experimentation will naturally lead to a purposeful study of many musical instruments used to-day, and to beginnings in the knowledge of various kinds of vibrations and intervals represented in these instruments.

Learning what tools were used for writing by early man. The tools or instruments used in writing among the Indians



© *Ewing Galloway*

FIG. 243. An Old Mill in New England



Courtesy Metropolitan Museum of Art

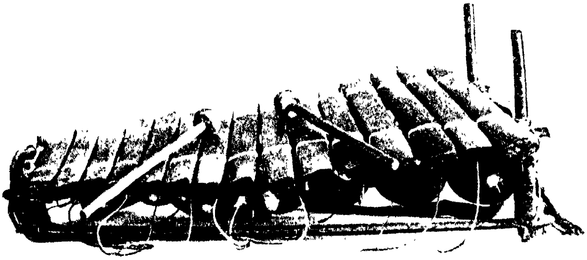
FIG. 244. Drums of Primitive Peoples

South America

Hawaii

Africa

and early Oriental peoples, as found in the study of records, include marking sticks or pens for writing on skins, papyrus, or parchment; the sharp stick or metal stylus for writing in clay or wax; and metal chisels for writing on stone. These should be compared with the writing instruments used by the children themselves — pencils, pens, and brushes.



Courtesy Metropolitan Museum of Art

FIG. 245. An African Marimba

Desirable outcomes in Grade III. From this work the teacher may expect:

1. A knowledge of a larger number of tools and machines used in the production of foods.
2. An appreciation of the contrast between ancient and modern sowing, cultivating, harvesting, threshing, and milling methods.
3. Knowledge of a wider range of simple forms of spinning and weaving implements.
4. A wider acquaintance with the vehicles, musical instruments, and writing implements of early peoples.
5. A growing interest in the mechanical devices of water wheels, windmills, traps, snares, and bows and arrows.

GRADE IV

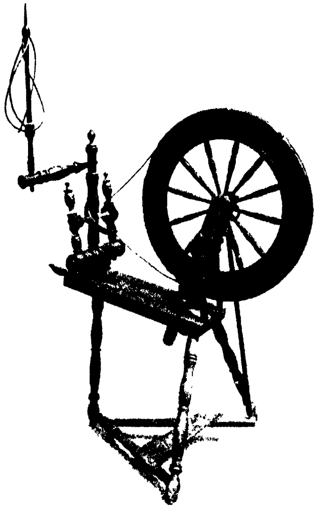
Considering other machines used. *In producing foods.* In the study of foods, the use of the ice-cream freezer and of the refrigerator may be taken up in this grade. Children are now mature enough to understand the principles used in these devices if presented simply. Keeping temperatures low by the evaporation of water from the *olla*, or porous jar, as practiced in warm countries, may be considered. An iceless refrigerator may be made.

In connection with the study of our water supply, the various devices for getting water from wells may include the use of the well sweep, the pulley and rope, the windlass and rope, the chain pump, and the valve pump, the last as operated by hand or by the windmill or gas engine. With this study, the air pump as illustrated by the tire pump may be considered to show more fully the operation of the valve mechanism. Calling attention to the method of operating popguns, pea shooters, and air rifles will still further illustrate the use of the pressure of air as a helpful force. The simpler principles involved in all of these devices may be noted. When the devices themselves cannot be found in operation in the community, descriptions and pictures will help to make their methods of operation clear.

In producing clothing. In clothing studies, the several forms of spinning wheels and looms found among the Greek people and the American colonists will be observed as steps in progress beyond earlier peoples. The two-shaft heddle, the shuttle, and the batten will be new features of looms. The loom used by the Greek Penelope, while awaiting the return of Ulysses, had two-shaft heddles and was of the two-heddle type. A reel for unwinding the silk fibers from cocoons may be made in connection with the study of silk.

In producing utensils and records. In the study of utensils, the potter's wheel is included, and the use of the one-piece mold is learned. In the history of the Greeks and Romans, the tablet and stylus will be found in use for writing. Children like to make these.

In making products of wood. Arising from interests quite apart from specific school studies, an increasing usage of woodworking tools may develop. Among the products which children may wish to make are toys, models of vehicles, sleds, bird houses, traps, stilts, and roller coasters. In such constructions of wood, tools which may be used include planes, chisels, the drawing knife, the marking gauge, bits, countersinks, rasps, and sandpaper. In learning how the edged tools are kept sharp, the children will find how the whetstone, grindstone, oilstone, emery wheel, and file are used. Attention should be called to the proper use and care of these tools, but the work in sharpening will have to be done chiefly by older persons. The children will be interested, however, in what should be used for sharpening each respective tool, and why one means rather than another is used. Emphasize the avoidance of accidents.

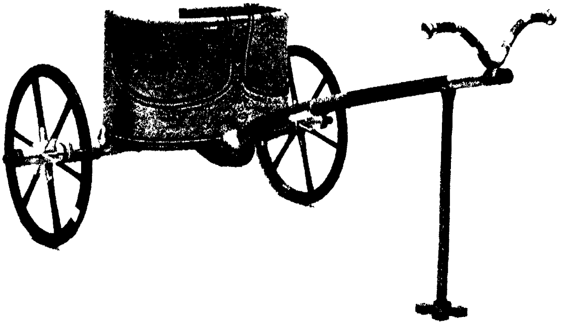


Courtesy Metropolitan Museum of Art

FIG. 246. A Colonial Flax Wheel

Comparing cutting tools. Comparing butter knives, bread knives, table knives, butcher knives, axes, planes, chisels, scissors blades, razor blades, sickles, saws, and other cutting edges will lead to an appreciation of the fact that each type of knife or cutting tool is adapted to the kind of material which it is made to cut.

Noting metal-working tools and machines. In connection with constructive work observed in iron, tin, and other metals, the use of anvils and hammers, chisels, hack saws, files, wrenches, drills, tongs, pliers, punches, soldering irons, and the forge will be noted. The differences between the tools used in wood and metals should be indicated.



Courtesy Metropolitan Museum of Art

FIG. 247. A Modern Model of an Eighteenth Dynasty Egyptian Chariot The original was found at Thebes in the Valley of the Kings.

Comparing ancient vehicles with modern. Chariots of strength and splendor for use in war and for pageants and races will be found among the Assyrians, Egyptians, Greeks, and Romans. Boats with two rows of oarsmen on each side, and some with three or more, will be found in use by the Romans in ancient warfare. The boat with two rows of oars on each side was called a *bireme;* with three, a *trireme.* Paddle wheels placed at the sides of boats and driven by a

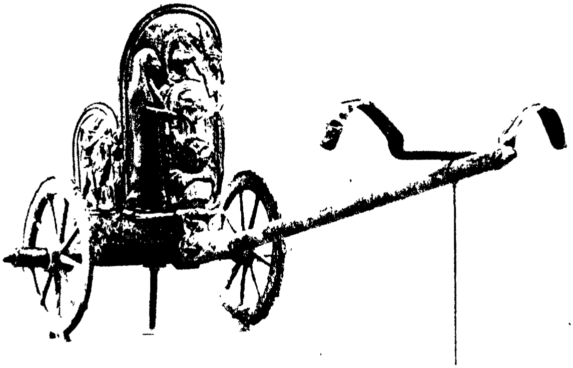

Courtesy Metropolitan Museum of Art

FIG. 248 A Bronze Etruscan Chariot of the Sixth Century B C

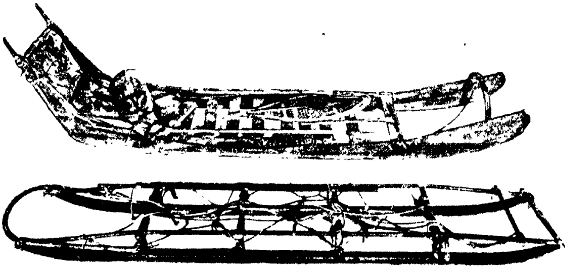

Courtesy American Museum of Natural History

FIG. 249 Modern Sleds Used in the Polar Regions

The upper reached the North Pole, the lower the South Pole.

treadmill operated by horses or oxen were used at times by the Romans, but these were of little practical help until the invention of the steamboat at the beginning of the nineteenth century. As the vehicles and other implements of peoples studied in history, geography, or literature are found to be different from our own or from those of earlier peoples, note should be taken of these differences, and, as far as possible, the reasons for them determined.

Courtesy Metropolitan Museum of Art

FIG. 250. A Greek Ax Head of Bronze

Listing various devices used by the Greeks and Romans. Among the Greeks and Romans, many miscellaneous tools will be found in use — knives, swords, catapults, battering rams, hoes, rakes, plows, instruments for working in wood, metal, and stone, and musical instruments. Attention should be called to the progress from earlier times as indicated by these, in both their variety and their improvement in workmanship and finish. For heating rooms, the Greeks used the brazier, a pan on legs in which a fire of charcoal was made. The Romans used the brazier, and they also sometimes built fire rooms, or *hypocausts*, in cellars below the living rooms. These fire rooms were connected with the rooms above by clay pipes, prophetic of our modern furnaces.

Courtesy Metropolitan Museum of Art

FIG. 251. Egyptian Bronze Lamp of the Roman Period

Desirable outcomes in Grade IV. From this work the teacher may expect:

1. A knowledge of the operation of the ice-cream freezer, refrigerator, and various kinds of pumps.
2. An acquaintance with forms of spinning and weaving devices of early European and colonial days, indicating progress from more primitive forms.
3. A knowledge of the potter's wheel.
4. An increasing facility in the use and care of tools for woodworking and work in clothing materials.
5. An appreciation of the adaptation of each form of cutting tool to its particular purpose.
6. Some knowledge of metal-working tools and the differences between these and woodworking tools.
7. An increased knowledge and appreciation of the development of vehicles.
8. Some acquaintance with the writing instruments, household tools, and living facilities of the Greeks and Romans.

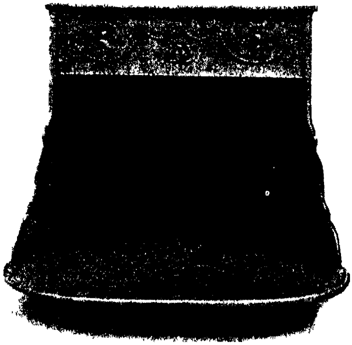
GRADE V

Finding the changes in food production made by modern inventions. Connected with the study of foods and the related industrial geography, there will be occasional reference to tools and machinery used in gardening, plowing, planting, and cultivating crops, harvesting, and threshing. Comparisons of the tools and implements used to-day with those of the other peoples studied in this year and with the earlier periods in American history, should be made, and the changes in life for both producers and consumers resulting from improvements in machinery much emphasized. Explanations of the principles used in modern machines should be developed as far as they can be understood. Interest in the making of illustrative models showing steps in progress should be encouraged. Charts made up of pictures showing progress may also be made.

In the study of the changes in the production of foods resulting from the invention of new farming implements and machines, the following inventions are among the more important for consideration: The first cast-iron plow of one piece, by Charles Newbold of New Jersey in 1796; the steel plow by Jetham Wood of New York in 1797, much improved by him in 1819; the gang plow about 1850; the steam plow by Foy in 1879; the threshing machine by Andrew Merkle in 1788; the modern form of thresher by Roberts in 1852; the reaper by McCormick in 1831, with improvements in 1834; the self-rake, for raking the grain off the reaper in bundles, by Seymour in 1851; the Marsh harvester, with a carriage for two men to ride to bind the grain as it was elevated to them, by C. W. and W. W. Marsh in 1858; the automatic binder, using wire, by Bekil in 1864; the twine binder by Gorham in 1873; the automatic, knot-tying twine binder by Appleby in 1879; and the combined harvester and thresher by Matteson in 1886. Other important inventions connected with food preparation or preservation are the roller-mill process for making flour by Wegman in 1875; the cream separator by De Laval in 1880; and a machine for making ice by Garrio in 1851. A great variety of other improvements not ranking as major inventions have been developed within the last hundred years in planting, cultivating, and harvesting machinery by which the present efficient methods of farming have been accomplished.

Many improvements in household tools and devices for preparing and using foods will also be found which have resulted from a century of invention, and likewise there will be noted a great variety of discoveries and inventions in use in the commercial manufacture of food products in all fields.

Learning of machines invented for producing shelter and furnishings. In the studies of housing and furnishing, attention may be directed to the tools and machines of the present, and contrasts made with the meager conveniences and labor-saving devices of the past. This will include consideration of elevators; gas lights and stoves; electric lights, bells, irons, toasters, percolaters, stoves, vacuum cleaners, heaters, fans, and sewing machines; of flour mixers and dish washers; of furnaces and hot-water systems; of the telephone and radio; and of musical instruments, including the player piano and the phonograph. Some of the notable inventions in this connection are those of the elevator by Otis in 1861; the carpet sweeper by Bissell in 1876; the telephone by Bell in 1876; the phonograph, first as the talking machine, by Edison in 1878, and in the new form as the graphophone by Bell and Taintner in 1886; the dynamo by Wilde in England and Siemens in Germany in 1866; the electric light in the incandescent form by Edison, and the arc form perfected by Brush, in 1878; the tungsten film for incandescent lights by Just and Hanamon in 1911; making gas from coal by Hales in 1726; the stovepipe to carry off smoke by Savant, a Frenchman, in 1700, and the improved stove, still used in parts of the United States, by



Courtesy Metropolitan Museum of Art

FIG. 252 A Cast Iron Franklin Stove

Benjamin Franklin in 1742; the oil lamp with a chimney by Argand in 1783; the gas light by Murdock in 1797, and the gas mantle burner by Welsbach in 1885; the modern form of piano in its essential features by Custofori in 1709; and the piano player by White in 1897.

In building construction, many new machines will be found in use, among which are hoisting cranes and derricks; automatic drills and power shovels for excavating; automatic riveting machines; power concrete mixers; machines for making bricks and tiles; and numerous other machines for preparing materials to make them ready for the builders. Among these machines for preparing materials are power saws, planers, lathes, milling machines, jointers, shapers, drill presses, and various forms of steamfitters' and plumbers' tools and machines. Noteworthy inventions in this field are those of the wood-planing machine by Woodworth in 1828; the rock drill by Hermon in 1854; and the band saw by Prescott in 1887. Pupils may be impressed by the relative recency of some of these inventions. The industrial and social con-

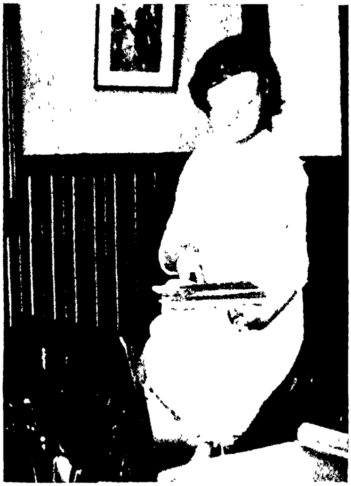
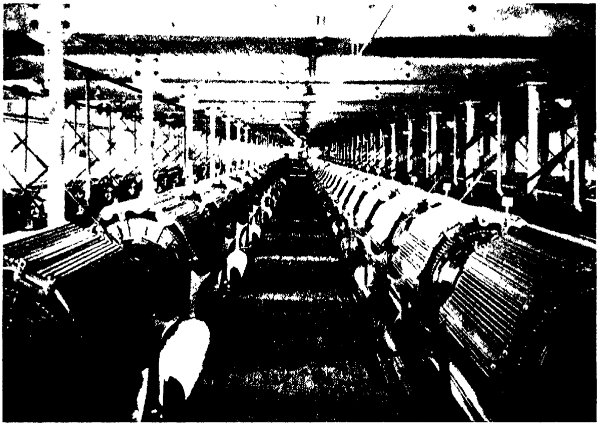


FIG. 253. Carding by Hand in a Passaic, New Jersey, School

sequences of their use should be emphasized. Some of the comparisons, in time and money saved, by reference to the tables in the work following for Grade VI will be of interest also in this grade.

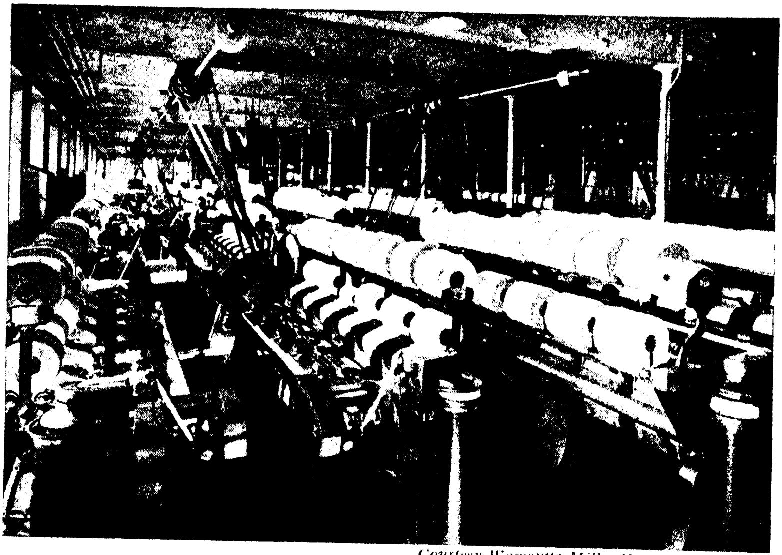
Various other devices will be found in use, such as the crowbar, inclined plane, lifting jack, block and tackle, and windlass. The mechanical principles upon which each of these depends for its operation may be explained and other illustrations of these same principles observed as used in the environment. In caring for lawns and hedges, lawn mowers operated by hand power, horse power, and tractor, sprinkling devices, clippers, and sickles may be observed.



Courtesy Wamsutta Mills, New Bedford, Mass.

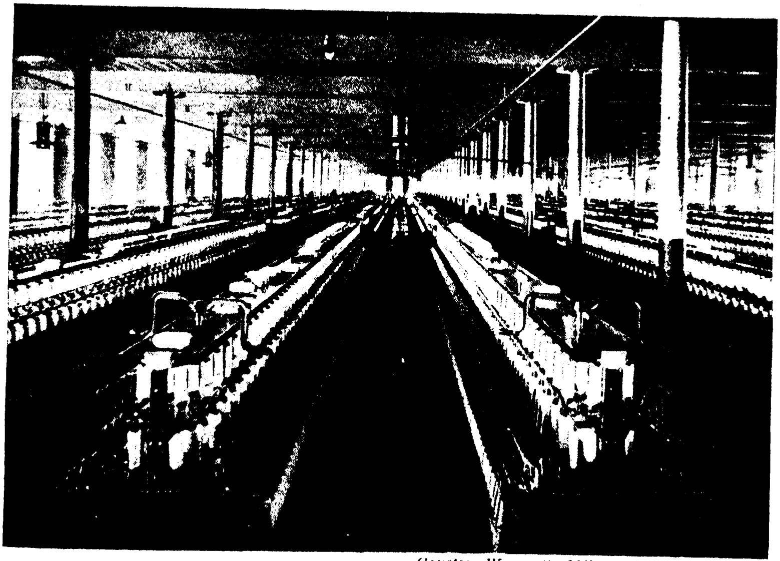
FIG. 254 Carding in a Factory

Considering machines used in making fabrics and garments. In connection with the study of clothing, a considerable number of very important changes in the making of textile fabrics and garments may be observed and their



Courtesy Wamsutta Mills, New Bedford, Mass.

FIG. 255. Combing Cotton in a Factory



Courtesy Wamsutta Mills, New Bedford, Mass.

FIG. 256. Spinning Cotton in a Factory

advantages noted. Among these are the changes brought about by the cotton gin, invented by Eli Whitney in 1793; the flying shuttle by John Kay in 1733; the simple spinning machine by Lewis Paul and John Wyatt in 1738; the spinning jenny by John Hargreaves about 1765, and improved by Richard Arkwright about 1768; the mule spinning frame by Samuel Crompton in 1799; the power loom by Edmund Cartwright in 1785; the pattern-weaving loom by Jacquard in 1804; the Lyall loom by Lyall in 1872; knitting machinery by Lamb in 1866; and the sewing machine by Elias Howe in 1846. The process for mercerizing cotton was invented by Mercer in 1851, and the method of making artificial silk by De Chardonnet in 1888. The vulcanizing of rubber was accomplished by Goodyear

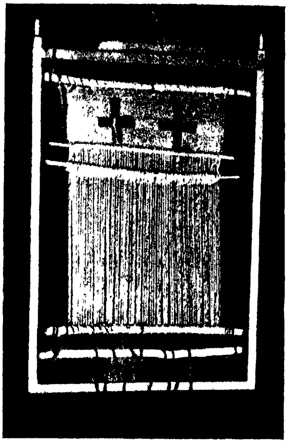


FIG. 257. An Indian Rug Loom with a String and Stick Heddle

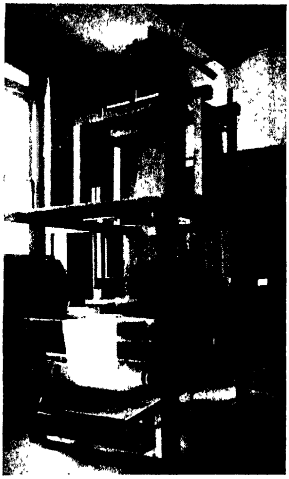


FIG. 258. A Jacquard Loom

in 1839, making possible our modern garments of rubber. In addition to the machines for making fabrics and garments are the modern machines for washing and ironing clothes, and the advantages of these should be pointed out as they are found in use in homes and commercial laundries.

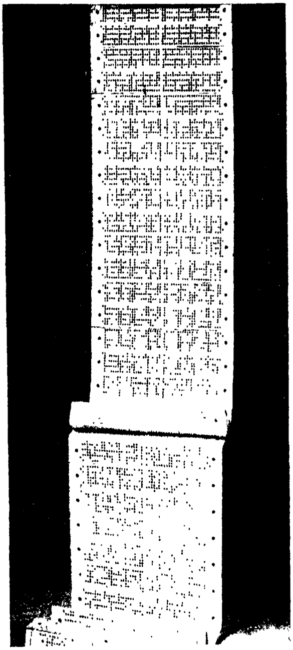


Fig. 259 Part of Pattern Used on a Jacquard Loom for Weaving Silk Dress Goods

Making a cotton gin. In order to appreciate more fully the problem of removing the cotton from the seeds, a simple form of cotton gin may be made and the hand and machine methods compared. To make a simple form of cotton gin, take a box about ten inches square and four inches deep. Out of a piece of cylindrical wood two or three inches in diameter, make a roller which will fit the inside dimension of the box. Into one end of the roller drive a wire nail for an axle; in the other end place a wire four or five inches long to be used as an axle and also bent into a crank for turning the roller. Mount this roller on the top of the box in grooves made three inches from one side. Into the roller drive four rows of small finishing wire nails, one-fourth of an inch apart, from one end to the other, arranged spirally around the roller. Drive the nails so that they project one inch out of the roller.

Into the edge of a wooden bar as long as the box, two inches wide, and three-fourths of an inch thick, drive a row of nails like those driven into the roller, one-fourth of an inch apart, and projecting one inch out of the edge of the bar. To the top of the box, on the open side, nail this bar parallel with the roller one and one-eighth inches from it, placing it so that the nails in the roller will go midway between those on the bar when the roller is turned. The cotton is placed above the nails on the bar, and the roller

Courtesy Wamsutta Mills, New Bedford, Mass.

FIG 260 Looms for Weaving Cloth in a Modern Textile Factory

is turned so that the spirals of nails pull the fibers off the seeds down into the box. The seeds are too big to go through the spaces between the nails.

Finding what machines are used in making records. In the study of records, the steps forward in the work of this

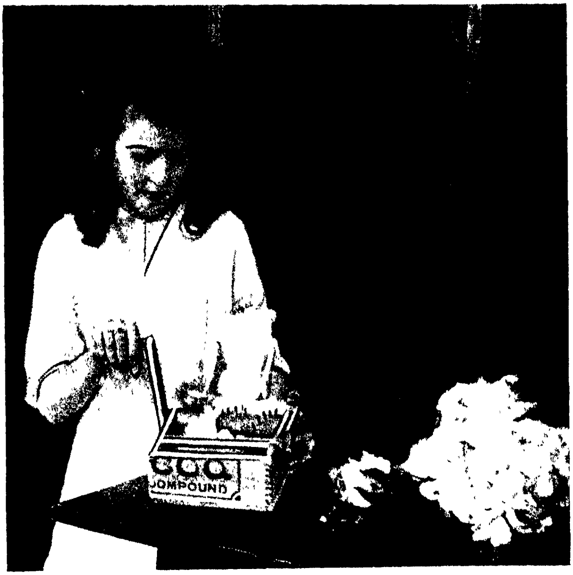


FIG. 261. Using a Cotton Gin Made in School

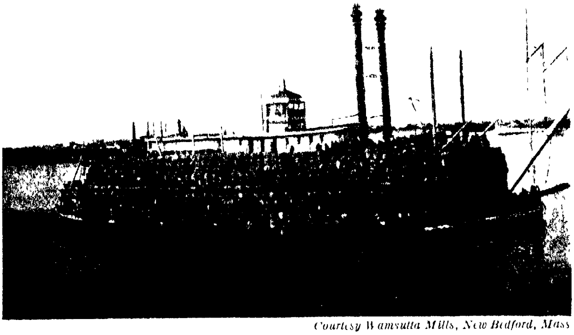
grade include the changes from the invention of movable type to the present variety of type-setting machines and printing presses. There are also a number of other important methods of recording and communicating ideas. Some of these are the results of such inventions as the following:

Printing by the use of movable type by John Gutenberg in 1434, and rapidly developed by his assistants, Faust and Schaeffer; the printing of the first book in England by Caxton in 1476; stereotyping by William Ged about 1725; lithographing by Senefelder in 1776; the cylinder press in a form not practically successful by Nicholson about 1812, and in a highly successful form by R. Hoe in 1845 with improvements in 1847; the rotary, continuous feeding press by Bullock in 1865; the linotype machine by Mergenthaler in 1884; the monotype machine by Lanston in 1887; the autoplate process for making printing plates by Wise Wood in 1897; the rapid rotary press, doubling the speed of printing, by Wise Wood in 1910; the wood-pulp paper-making process in 1853; the typewriter by Thurber in

Courtesy Wamsutta Mills, New Bedford, Mass

FIG. 262. Cotton by Rail to the Factory

1843, but not practically successful until the improvements of Sholes in 1868; the electric telegraph by Morse, patented in 1837; the duplex and multiplex methods of telegraphing by Edison in 1873; wireless telegraphy by Marconi, 1890–1896; the daguerreotype form of photography by Daguerre in 1829; other forms of photography by Niepce in 1827, improved by Talbot in 1839; the hand photograph camera by Schmid in 1881; the kodak and photographic film by Eastman in 1888; the first form of the moving-picture machine, the kinetoscope, by Edison in 1890; the telephone by Bell in 1876; the cash register by Patterson in 1885; and the adding machine by Burroughs in 1888. Stenography was developed through several systems of shorthand in the last century, and recently a stenotype machine for writing a form of shorthand has been invented and successfully used. The phonograph, noted in the fourth grade, will be recalled as a means of recording speech, and closely connecting the phonograph and the typewriter is the dic-



Courtesy Wamsutta Mills, New Bedford, Mass

FIG. 263. Cotton by Steamboat to the Factory

taphone, a machine which is used for recording dictation on a prepared cylinder and giving it out again at a later time for writing by a typist.

Investigating the evolution of vehicles. Vehicles are found in our day for travel and transportation over the land, upon the water, under the water, and in the air. From the wheelbarrow and the simplest forms of sleds, carts, and wagons, and from the most primitive forms of rafts and boats up to the most modern forms of vehicles for both land and water transportation, all forms which have ever been used are still used. Some of the work done by vehicles used for twenty or thirty centuries can be done better by these forms than by the most modern vehicles. The particular work for which each form of vehicle is best suited should be considered in the study of means for transportation. This will include drags and sleds of various kinds; wheeled vehicles as propelled by different kinds of power — by man, draft animals, steam, electricity, and gasoline; water craft as carried by currents of water, wind, oarsmen, steam, electricity, and gasoline; and balloons propelled by the air, and dirigible balloons and airplanes driven by gas engines.

Among the inventions of particular significance in the development of modern vehicles are these: The steam engine by Hero about 120 B.C., but not in a practical form; a steam engine of practical form by James Watt in 1765, and improved by him in 1769; the steamboat by Lord Dundas in Scotland in 1802, and by Robert Fulton in the United States in 1807; the screw propeller by John Stevens of Hoboken, New Jersey, in 1805, improved and made practical by John Ericsson in 1839; the first locomotive used on rails by George Stephenson in 1814; the first locomotive put to use in the United States in 1829; the first large locomotive in the United States by Baldwin in 1832;

the steam whistle by Stephenson in 1833; the sleeping car by Woodruff in 1856; the air brake by Westinghouse in 1868; the automatic car coupler by Janney in 1873; the electric motor by Jacobi in 1834; the trolley car by Van Depoele and Sprague in 1884–1887, although the Siemens Brothers had made an electric car with a third rail between the wheelways in 1879; the electric locomotive by C. G. Page in 1851; the gas engine by Otto in 1877; the gasoline automobile by Daimler in 1890; the cable car by Gardner in 1858; the balloon by Joseph and Stephen Montgolfier in 1783; the dirigible balloon by Santos Dumont in 1901; the airplane by Wright Brothers in 1903; the hydroplane by Glenn Curtis in 1911; the pneumatic tire by R. W. Thompson in 1845, but first used practically on bicycles in 1889; the old, ordinary form of bicycle by Michaux in 1855, the safety bicycle by Marble in 1884; and the modern cash carrier by Brown in 1875.

In connection with the study of vehicles, the development of road making should be considered. The efficiency of the Romans as road makers was probably noted when the Roman people were studied. The problems of making post roads and national roads in the early part of the last century in the United States should be recalled. The Macadam method of road making was invented about 1810 by John McAdam in England. Modern methods of making cement and asphalt and of crushing stones by power crushers have made it much less expensive to make hard roads than in earlier days. The growing use of the automobile has stimulated interest in road making in recent years. Canal building should also be noted as it has developed in this country. Our industrial, economic, social, and educational needs are all much more fully and easily met by having excellent roads for rapid travel and exchange of goods.

Finding what machines are used in making utensils. In the study of utensils, the wheel of the potter as used among early peoples, the modern power-driven forms of wheels, the uses of jollies and jiggers, of templates, of molds, of the devices for glazing and decorating, and the kilns for firing will all be of interest in helping to explain the differences in wares found in homes and stores. The devices used in glass making should also be studied briefly in this connection. In the making of metal utensils will be found the various hammers, mallets, soldering irons, and brazing tools used in producing copper and brass wares and wares of silver and gold; and the shears, soldering irons, riveting implements, shaping tools, and machines for spinning and pressing or stamping utensils of tin, iron, and aluminum.

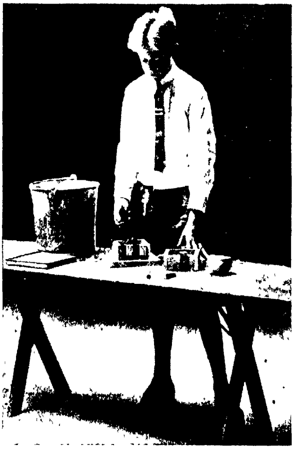


FIG. 264. Casting: Putting the Molding Sand in the Drag

Making a paper weight by metal casting. In making tools and machines and the multiform other metal products of to-day, the problems of casting, rolling, stamping, pressing, forging, and machining will be noted by the children. Enough should be learned about these to make the general methods reasonably well understood. When such studies are made, blacksmith shops, foundries, pattern-making shops, and machine shops should be visited when possible. The essential processes of metal casting may be shown by making a small paper weight of lead, babbitt metal, pewter, or soft solder. In this work in molding, connection should be made with the making of pottery molds described in the chapter on Utensils.

A pattern should be made of wood of the size and design desired. This pattern should not be over two inches square nor more than an inch in height. The sides should be tapered slightly, making the pattern a little smaller at the top than at the bottom so that it may be drawn easily from the molding sand. Suggestions of designs easily made are found in Fig. 267.

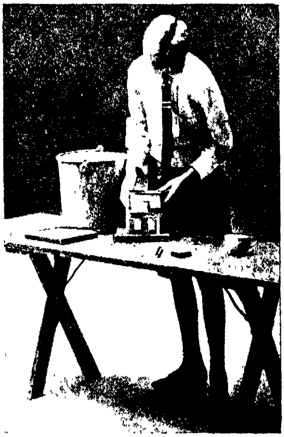


FIG. 265 Casting. Fitting the Cope over the Drag

To make the molding flask, make two rectangular frames exactly alike. A convenient size is 8″ long, 6″ wide, and 2″ deep, outside dimensions, for each frame. A bottom board a little larger than the box-like frame is needed. The bottom frame, called the *drag*, is placed on the board, and the top frame, called the *cope*, is placed so that it fits exactly over the drag. To make the two parts fit exactly, nail two strips of wood about half an inch thick, an inch wide, and two inches long, one inch apart on each end of the lower frame, or drag. To the upper frame, or cope, at each end nail a similar piece of wood three and one-half inches long so that it will fit down over the drag between the two similar pieces.

When the cope is placed upon the drag the two should register exactly.

To make the mold in this flask, place the pattern, large side down, on the middle of the bottom board. Place the drag over and around it. Fill the drag to the top with damp, fine sand, tamping it firmly. Get molding sand if you can. Place another board on top of the drag and make an even, smooth surface of the sand. Remove the top board and turn the drag over. The bottom of the pattern will be exposed. Fit the cope to the drag and sprinkle a thin layer of fine, dry sand over the damp surface of the sand in the drag. Fill the cope with damp sand, tamping firmly. A tapering pin, about a half inch in diameter at its larger end, called a *sprue pin*, is now put through the sand of the cope so that it will extend a little over a quarter of an inch into the sand of the drag at about one inch from the end or corner of the pattern. Pack the sand in the cope around the pin and withdraw the pin. This leaves a hole in the cope. Remove the cope and carefully lay aside. Cut a small channel, called the *gate*, in the surface of the sand in

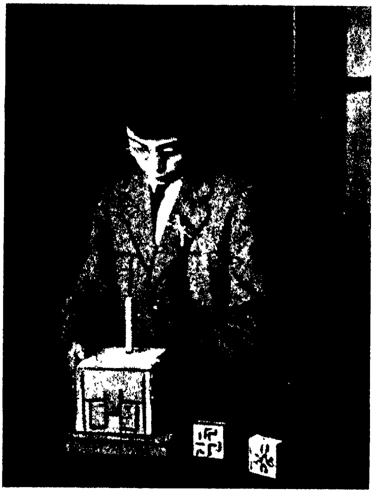


FIG. 266. Casting: The Sprue Pin in Place

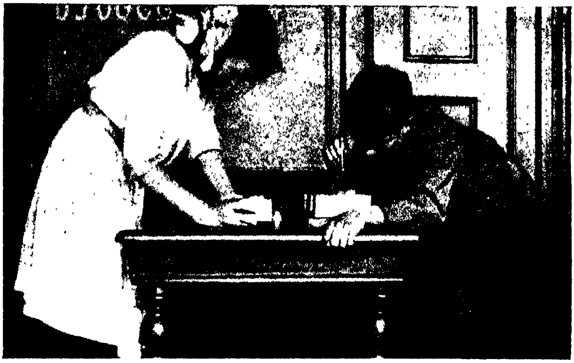


FIG. 267. Casting: Removing the Pattern

the drag from the sprue hole to the pattern. Carefully drive a sharp tack into the bottom of the pattern to serve as a handle, and remove the pattern by lifting it straight

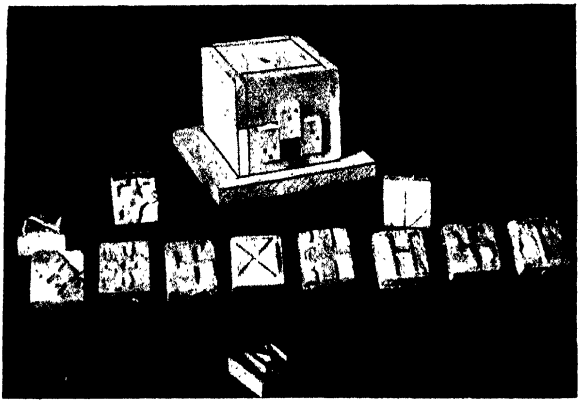


FIG. 268. Casting: Ready for Pouring

up, out of the drag. Carefully punch a large nail almost through the sand of the cope in two or three places to allow for escaping steam formed when the hot metal is poured into the damp sand. Fit the cope over the drag, and the flask is ready for pouring.

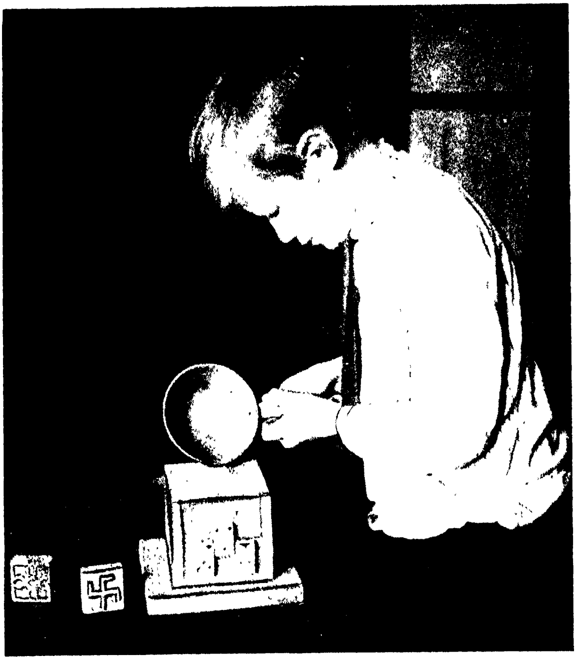


FIG. 269. Casting: Pouring the Metal into the Flask

Heat the metal to be used in an iron pot or ladle on a stove, and, when fully melted, pour into the sprue hole until it is filled to the top. When cool, remove the casting from the flask. Break or saw the metal projecting from the gate and smooth any rough places by filing.

A number of inventions in this field of working in metals are important, among which are the following: The hydrostatic press, by Bramah about 1795; the steam hammer by James Nasmyth in 1842; the Bessemer steel process by Benjamin Bessemer in 1856; electroplating by Brugnatelli in 1803; the galvanizing of iron by Crawford in 1837; barbed wire in 1861, and the barbed wire-making machine by Glidden in 1874; the making of armor plate by Harvey in 1888; electric welding by Thomson in 1889; and carborundum, one of the hardest abrasives, by Acheson in 1893. Brief ac-

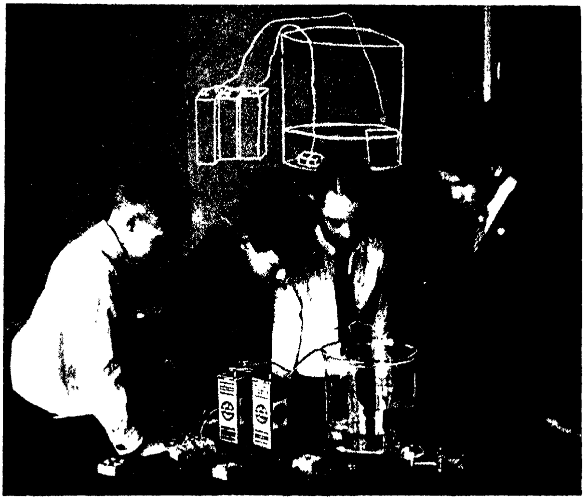
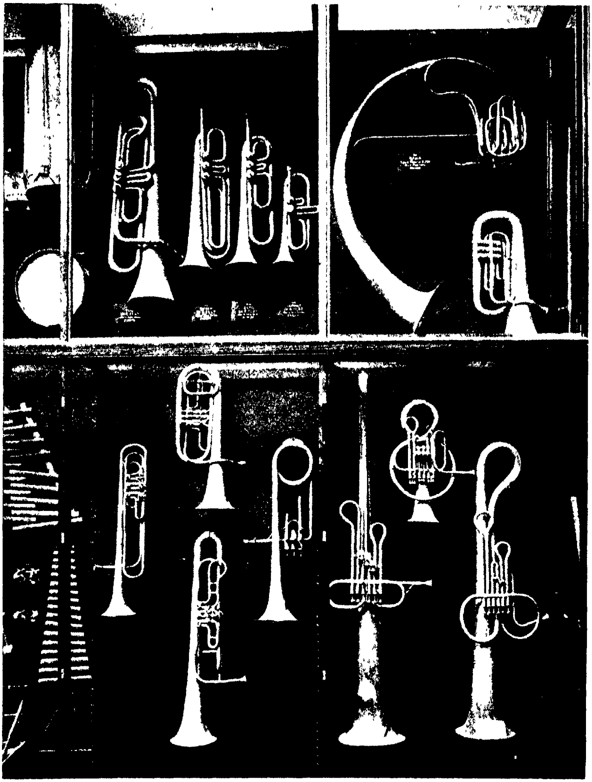


FIG. 270. Electroplating a Paper Weight

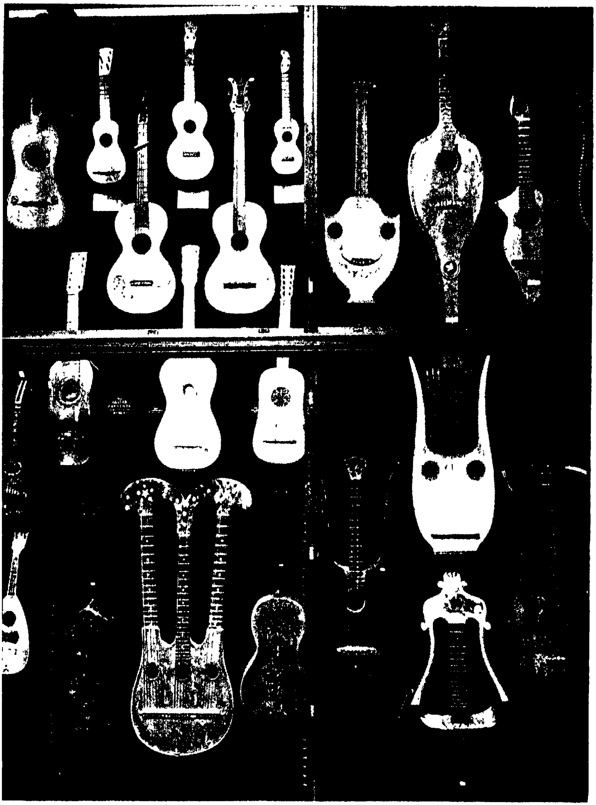
counts should be read of the more significant processes in the converting and shaping of the heavier products of iron. Something should also be learned of the working problems and conditions in these large plants.



Courtesy Metropolitan Museum of Art

FIG. 271. Some Forms of Wind and Percussion Musical Instruments

Electroplating a paper weight. An interesting experiment and a pleasing product may be made by placing one of the paper weights, which has been cast, into a jar containing



Courtesy Metropolitan Museum of Art

FIG. 272. Some Forms of Stringed Musical Instruments

enough copper sulphate to cover it; attaching to this weight from a battery of two or three cells the negative wire, the wire from the rim of the cylindrical top if dry cells are used; and attaching to the positive wire a piece of sheet copper one inch by two or three inches, placing this in the copper sulphate. The cells of the battery should be connected in parallel. See Fig. 270. Copper will be deposited on the paper weight, completely plating it with a thin layer in a few hours.

Investigating musical instruments. In the study of musical instruments, the three classes as to the sources of vibrations — the percussion, the wind, and the stringed — may be considered and particular instruments of each type investigated. Much experimentation may be profitable. This may be with both common, present-day instruments, and historical forms as found in the study of earlier peoples. Through the experimental initiative of the children, new forms may be invented. Marimbas, whistles, pipes, bells, glasses partly filled with water, drum forms, and fiddles, or other stringed instruments made with various kinds of sounding boards may be constructed and furnish the means for much profitable experience and enjoyment. Textbooks with treatments of the physics of sound will be helpful as references.

Desirable outcomes in Grade V. From this work the teacher may expect:

1. An increased knowledge of the new machines invented since the beginning of the Industrial Revolution for the production of food materials.
2. An acquaintance with modern inventions and improvements in building construction and materials, and an appreciation of the resulting comforts and conveniences.
3. A knowledge and appreciation of the inventions for textile and garment manufacture from the Industrial Revolution to the present.

4. An understanding of the inventions and improvements in printing, publishing, and other forms of devices for writing and communicating since the days of Gutenberg.

5. A knowledge and appreciation of the evolution of vehicles.

6. An acquaintance with the modern devices and methods used in the making of utensils.

7. A knowledge and appreciation of casting and otherwise shaping and finishing metal products, including the process of electroplating.

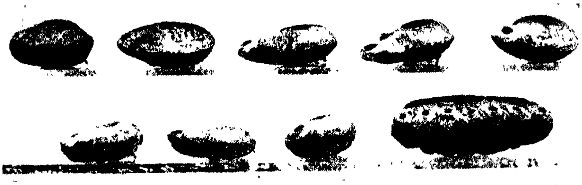
8. A knowledge and appreciation of the principles employed in making musical instruments.

9. A growing appreciation of the place and meaning of the uses of machinery in the modern world, together with some of the social problems resulting.

GRADE VI

Making a summary of the development of tools and machines. In this grade, there may well be made a summary of the various tools and machines of each field as it is taken up for study with reference to its own purposes. Two factors should be emphasized, namely, the more simple principles illustrated by their operation; and the industrial and social changes resulting from the use of the most important inventions in each field.

Investigating principles of operation of machines. The use of the three kinds of levers will be found in machines of almost every kind — in pump handles, in using the oars in rowing, in scissors and tongs, in the use of the crowbar, in can openers, in numerous other devices, and in the adjustment of parts and the shifting of gears in almost all common machines. The use of the principle of the wheel and axle will be observed in the pedals of the bicycle, the crank of the automobile, the barrel churn, the ice-cream freezer, the windlass, and in other familiar applications. The pulley and the block and tackle will be found in wells where the bucket, rope, and pulley are used for lifting water, in the operation of hay forks in filling barns, in many varieties of derricks and cranes, and in hoisting pianos and other heavy bodies to upper rooms. The buoyancy of water in supporting boats and of the air in supporting balloons will readily be noted. The driving force of the air in motion will be observed in operation in the sailing of boats, the flying of kites, the voyages of balloons, and the turning of windmills. The reverse operation of a force acting against water and air will be seen in the driving forward of boats by oars, paddle wheels, and screw propellers, and of dirigible balloons and airplanes by screw propellers. The reduction of friction and the consequent ease of drawing loads over land surfaces will be noted in sleds, ice skates, skis, roller skates, bicycles, and all other wheeled vehicles traveling upon land or upon rails. The changes of direction of forces, enabling one to apply them wherever he will, and to produce motion at any desired rate of speed, will be seen in the use of pulleys, of sprocket wheels in bicycles, and of forms of gears found in almost all machines. The several forms of belts and gears should be noted. These and other common principles may be observed in the operation of farm



Courtesy Metropolitan Museum of Art

FIG. 273 Ancient Egyptian Lamps

machinery, vehicles, building machinery, and household machinery all about one, wherever he may dwell.

Noting the industrial and social changes resulting from inventions. It is worth while to trace the evolution of various forms of tools and machines from their simplest beginnings to their present complex forms. By considering the changes in the well-being of man resulting from each invention, it will become increasingly apparent how fully man's progress in civilization and wealth has been parallel with his development of new tools and machines.

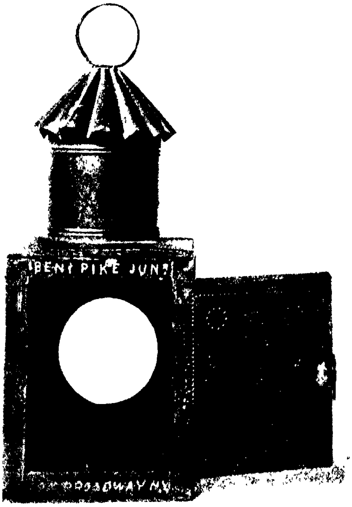


FIG. 274. A Watchman's Lantern of Dutch Days in New York

Simple knives, saws, and other edged tools were the beginnings from which have come the present-day power planers, saws, lathes, and other shaping machine tools which accomplish many times more work in a given time than the hand tools could achieve, and which also perform work which cannot be done with hand tools. The children should think the steps through from the simple hand spinning tools and looms to the great batteries of power spinning machines and looms in textile factories; from the simple forms of needles and thread to the various forms of electrically driven sewing machines; from the sickle and flail to the self-binder and threshing machine; from the monk's hand-printing to the work of the high speed, rotary printing press; from the slow processes of making shoes by hand to the rapid machine processes by which thousands of pairs of shoes are produced each day; from the travel by wagon at thirty miles a day to the travel by automobile at

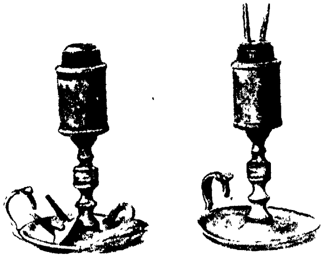


FIG. 275. Pewter Whale-Oil Lamps of the Colonial Period

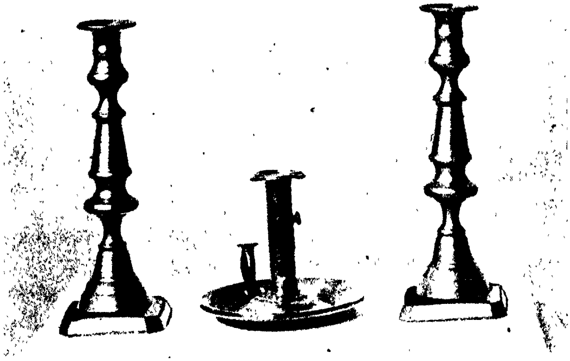


FIG. 276. Heirlooms of Colonial Days

thirty miles an hour; and so on, through an amazingly large number of fields which illustrate the contrast of life without efficient machines with our day when machines do most of the world's work.

Summarizing important modern inventions. In addition to the inventions listed in the work of the fifth grade, several others may be included, some relating directly to the definite units of industrial study, others to changes in fields more indirectly affecting industrial life but of much importance. Related to the development of sewing machines, first used in the sewing of textiles, are the welt shoe sewing machine for leather, invented by Goodyear in 1871, and the chain-stitch shoe sewing machine by French and Myers in 1884. Machines have also been invented for sewing pamphlets and books.

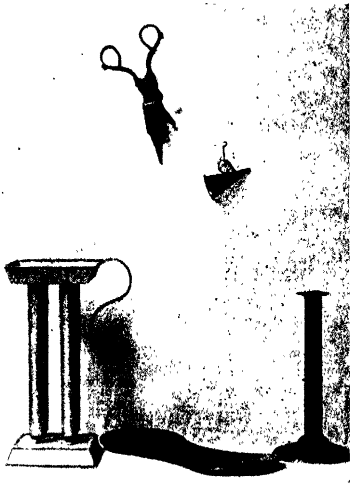


FIG. 277 Candle Molds, Snuffers, and Candlesticks

The stereoscope for giving the appearance of solidity, or including the dimension of depth, in pictures was invented by Brewster in 1849. Connected with many important problems was the invention of the thermometer, first the spirit thermometer by Diebel and Galileo in 1620, and later the mercury thermometer by Fahrenheit in 1720. The barometer, so useful in weather forecasting and measuring altitudes, was invented by Torricelli in 1645. In 1671 Newton invented the reflecting telescope, *adding greatly to the means of studying astronomy.*

Several inventions mark the history of making matches. Walker and Phillips invented the friction match in 1827; Pasch in 1844, and Lundstrom in 1855, the safety match; Dennison, a match-making machine in 1848; and Beecher, a rapid, continuous machine for making matches in 1888. Celluloid was invented by Hyatt in 1870. The X-rays were discovered by Roentgen in 1895, and air was successfully liquefied in the same year by Linde. The miners' safety lamp was invented by Davy in 1816. The first oil well was sunk by Drake in 1859.

In the field of firearms, a number of recent inventions are of interest. Among these are the revolver by Samuel Colt in 1836; the Gatling gun by Richard Gatling in 1862; the machine gun by Lewis in 1912; smokeless powder for sporting purposes by Schultze in 1863 and for military purposes by Vielle in 1886; the torpedo by Whitehead in 1866; dynamite by Nobel in 1868; and the gun silencer by Maxim in 1909.

Finding how clocks and watches have developed. In reviewing the evolution of clocks and watches of various forms from the early sundials, water clocks, and hourglasses down to the present great variety of clocks and watches, many small inventions will be noted. The changes have been very gradual. Most of the names of those making the changes have been lost. The first form of the pendulum clock seems to have been made some time in the tenth century, but it was not very successful. In 1370, Henry De

Vick made the first weight clock. About 1470 springs were first used in clocks, and the "portable clock" soon developed into a watch. As a result of the experiments of Galileo about 1650, the pendulum was brought into practical usage in clocks. A Dutch clock maker, Huygens, was one of the first to make a successful pendulum clock. To-day, clocks are found in a remarkable variety, and they are often used quite as much for decorative purposes in some houses as for keeping time. Some of the finer clocks are very beautiful, and some clocks have been made which are very ingenious in the mechanical activities they are made to perform.

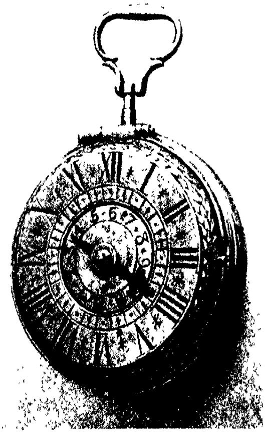

Courtesy Metropolitan Museum of Art

FIG. 278. A German Clock-Watch of Gilded Brass, Seventeenth-Eighteenth Century

Finding reductions in costs by the use of machines. To help us to appreciate how very great are the advantages of the use of modern machines and processes, we may select a number of kinds of work and compare the cost in labor and time required by the old ways and the new. The Thirteenth Annual Report of the United States Commissioner of Labor, Washington, D. C., devotes two volumes to a comparison of hand and machine labor. This report is for 1898. If the study were made now, a quarter of a century since 1898, the contrasts would be even greater. The following items, selected from a number of different fields, show the great gains in the reduction both of costs and of time by the use of machines in doing man's work.

DIFFERENCES IN COSTS OF LABOR BY HAND AND MACHINE METHODS

PRODUCTS	COSTS OF LABOR BY	
	Hand Methods	Machine Methods
One dozen men's woolen sweaters	$ 12.00	$1.16
500 square-head bolts, ¾″ × 12″ long	32.14	1.79
240 hardwood curtain poles, 1⅜″ × 60″ long	186.50	.87
1000 sewing machine needles	81.98	2.15
100,000 ems setting type, book work	46.00	5.69
100 sheet-iron signs, 36″ × 48″, 34 letters	200.00	.42
12 dozen 2-pound engineer's hammers	124.80	9.07
Shelling 100 bushels green peas	11.58	.58
Unloading 1000 bushels of grain	6.00	1.36
Drilling 2-inch hole 12 feet in hard blue rock	3.75	.36
12 hardwood bedsteads	141.90	6.07

Finding reductions in time by machine methods. Even more impressive is a comparison of the time required to do certain kinds of work by hand and machine methods. The table on the following page illustrates some of the gains made by the use of machine methods.

By the use of power to drive machinery, and with men trained to operate machines efficiently, man may to-day produce many times more in both the variety and amount of supplies than was possible in the days of hand production. With these increases in productivity has also gone an actual saving of time for the individual worker. His working day is relatively short, leaving much time for recreation and other interests not directly connected with his work.

DIFFERENCES IN TIME REQUIRED BY HAND AND MACHINE METHODS

UNITS OF WORK	TIME BY EACH METHOD			
	Hand		Machine	
	Hrs	*Min*	*Hrs*	*Min*
Cutting and binding one acre of wheat	11	34	1	0
Cutting and threshing one acre by hand and by "combined"	48	40	0	52.5
Planting one acre of corn	6	47.3	0	40
Shelling 100 bushels of peas	175	0	1	40
Making 25,000 pounds of soap	432	0	21	37.5
Making 100 pounds of 4-penny nails	236	25.3	1	49.4
Making 500 bolts ½″ × 6″ with nuts	43	10	8	12
Making 50 window frames 2–10 × 6–10	320	50	62	0
Pressing and binding 1000 paper-covered books	60	0	9	17.1
Making 1000 shoe boxes	228	0	34	30
Making 40 gross vegetable ivory buttons	190	0	15	0
Sewing 100 yards of carpet	20	0	3	8.2
Cutting out 100 men's vests	3	20	0	20
Working button holes on 100 Prince Albert coats	275	0	6	17.8
Making 100 pounds of cotton sewing thread	2895	0	39	17.8
Making 500 yards of 36″ cotton sheeting	5605	0	52	45.6
Mixing 1000 pounds of cracker dough	25	0	1	52.5

Considering social changes resulting from machine production. To carry on productive work in factories requires the coöperation of many, including both those who provide the materials and the plant, and those who do the work with the materials and the machines. Factory centers with congested living conditions have grown up in place of the rural or semi-rural homes of the days of hand, or domestic, industry. Child workers and women workers have frequently replaced men in changing to factory production. To make adjustments to the changed conditions of life and the new forms of coöperation has often been difficult and has frequently resulted in forms of abuse and injustice. The National Child Labor Organization has been formed to try to prevent children from doing work that is too hard for them, to keep them from working under conditions that are bad for their health or their morals, and to prevent their being deprived of an education. Labor organizations have also been formed for the mutual protection of the workers against abuses from their employers. Even the employers themselves have at times felt it necessary to form organizations to protect themselves against abuses from their workmen. The Consumers' League has been formed by consumers to try to help in securing desirable working conditions for those who produce the goods we need and in securing products of the quality claimed for them. To make adjustments that are fair and just to all — to the producers of the raw materials, to the owners of the plants who employ the laborers who do the producing, to the carriers who transport the materials and products, and to the consumers who use the products — is one of the largest industrial-social problems of our day. The more one knows of all of the conditions and of the history of their development, the more helpful he may be in solving this great problem.

With the increasing development and use of machines dangers to life and limb have greatly increased. To avoid accidents it is necessary to use almost constant care. On every appropriate occasion, the necessary means of caution and care to avoid injury should be noted and emphasized. Habits and attitudes of "safety first" should be developed in all children.

Desirable outcomes in Grade VI. From this work, the teacher may expect:

1. An enlarged appreciation of the evolution of tools and machines.
2. An understanding of the simpler principles by which machines are operated.
3. An increased appreciation of the changes in life resulting from inventions and improvements in tools and machines, and from modern methods of organized production.
4. An appreciation of the remarkable reduction in cost and time in production by the use of modern machines and methods.
5. An attitude of interest in inventions, discoveries, and methods of modern production, and some intelligence in interpreting their meaning in terms of social problems and social values.
6. Attitudes and habits of care in avoiding personal injury by tools and machines.

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Contains a good account of the evolution of spinning and weaving machinery.

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A simply written history of industry from primitive times with many good illustrations.

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Four volumes: Minerals; Products of the Soil; Manufactures; Transportation. The volume on Manufactures includes motors, glass, leather, boots and shoes, dressed meats, pins, needles, pens, paper, newspapers, and printing. Inexpensive and written in simple language.

SANFORD, ALBERT H. — *The Story of Agriculture in the United States.* Heath.

The history of agriculture from the Colonial Period, including agricultural practices of the Indians. Written in simple language. Good pictures of farming implements and machines.

SCHWARTZ, JULIA A. — *A Friend Indeed.* Macmillan.

Stories of seven periods in history in which the facilities of practical life are incidentally but effectively presented. Well adapted to intermediate grades.

SMITH, J. RUSSELL. — *The Story of Iron and Steel.* Appleton.

Treats of the making of iron and steel from the ore to finished products. Well illustrated.

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A list of publications will be sent on request. Many bulletins on industrial subjects are sent free or at very small cost. Consult the list frequently to see what is offered.

TAPPAN, EVA MARCH.—*Makers of Many Things.* Houghton Mifflin.

Includes matches, gloves, rubber, paper, books, pens, lead pencils, dishes, watches, shoes, cotton mills, and silk.

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Two volumes of this report are devoted to a comparison of hand and machine labor, bringing out many impressive contrasts between old ways and new ways of working.

CHAPTER XIII

HISTORY OF THE USE OF MATERIALS IN TEACHING IN AMERICA

The present confusion as to methods and objectives. Looking over the practice in elementary school teaching in this country, one is struck by the many kinds of handwork to be found. Nor is he less surprised by the great variety of reasons for its use which he hears when he asks teachers, parents, or children why they have such work. An examination of the beginnings of the use of materials may serve to explain the varied objectives and give guidance in planning modifications.

The Oswego movement.[1,2] In 1860, Dr. E. A. Sheldon, the superintendent of schools in Oswego, New York, first began giving his teachers instruction in the Pestalozzian principles. Joseph Naef, who had worked with Pestalozzi, had come to this country and introduced these ideas in a private school in Philadelphia but the attempt had failed, as had others. So, up to 1860, the ideas of Pestalozzi had no practical hold upon teaching in this country. Dr. Sheldon had been to Toronto, and had there learned of Dr. Mayo's institution in London where the latter had established a school carrying out Pestalozzi's ideas. Dr. Mayo had been a friend and pupil of Pestalozzi. So filled with in-

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[1] Hollis, A. P. — *The Contribution of the Oswego Normal School to Educational Progress in the United States.* Heath.

[2] Barnard's American Journal of Education. 1862: 605–628 and 633–645.

terest did the teachers in Oswego become from Dr. Sheldon's enthusiasm that a number gave up half of a year's salary to provide money to bring Miss M. E. M. Jones from London to introduce the Pestalozzian methods. She had been a training teacher in the model infant school of the Home and Colonial Infant School Society in which Dr. Mayo and his sister worked.

Herman Kreusi, the son of Pestalozzi's first associate at Burgdorf, who had taught in the Mayo school for five years, soon joined Miss Jones at Oswego.

Their efforts became a series of experiments in object teaching which attracted the attention of teachers from all over the country. Students came from many states to study here. Graduates from this school were sought by the leading normal school presidents and city superintendents, especially in the western states.[1]

"Oswego put a curriculum, embracing the 'three R's' it is true, but containing besides the wealth of work with nature, the study of plants, animals, soils, minerals, the air we breathe and the water we drink, the color exercises and form studies, the manual training and physical culture which form the main features of the progressive public schools all over the land to-day."[2]

"Oswego was the first state normal school in the United States to offer a definite course in kindergarten methods. Its kindergarten course was established in 1881. The music, the pictures, the warm colors, the merry games, the busy work, and happy faces of delighted children make these rooms an attractive feature for visitors."[3]

As noted in the foregoing, this widespread movement for object teaching had its inspiration in the work of

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[1] Barnard's American Journal of Education 1864: 94-102.

[2] Hollis, *op. cit.* (p. 464), p. 37. [3] Hollis, *op. cit.* (p. 464), p. 76.

Charles Mayo and his sister in England. Dr. Mayo had spent three years with Pestalozzi at Yverdon. Object teaching was definitely organized by them, and Miss Mayo wrote a manual of this highly formalized work which they had instituted. Hence, through this English influence, object teaching in America tended to be formalized, rather than informal and free, as was the spirit of Pestalozzi's method.[1]

The following report of a part of a lesson illustrates object teaching: "What is this? A flint. What is a flint? A sort of stone. Where do we find stones? In the earth. Look at it; what can you say of it? It is black. The teacher holds up the flint. What do you all say of the color of the flint? It is black. Repeat together: 'The flint is black.' What more do you see? It shines. All of you repeat: 'The flint shines.' Do you think a piece of flint would make a good window? No. Why not? We could not see through it. All repeat: 'We cannot see through flint.' Tell me some other things through which you cannot see. The walls, the slates, etc. Now pass the flint round and feel of it. What now can you say of it? It is hard: it is cold. Repeat together: 'The flint is hard and cold.' What more do you observe? It is smooth. Repeat: 'The flint is smooth'. . . ."[2]

The beginnings of kindergartens.[3] German immigrants of the educated class who came to this country, following the Revolution of 1848, opened private schools for their children in the cities in which they settled, in many instances including kindergartens — notably in Hoboken, New York City, Detroit, Milwaukee, and Louisville. The first was opened at Watertown, Wisconsin, by Mrs. Carl Schurz, a pupil of Froebel. From 1850 to 1860 several German kindergartens appeared.

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[1] Parker, S. C. — *History of Modern Elementary Education*, pp. 296-302. Ginn.

[2] Mayo, Elizabeth — *Lessons on Objects. Graduated Series, Arranged by E. A. Sheldon*, p. 38. Ivison, Blakeman & Co., New York.

[3] Vandewalker, Nina C. — *The Kindergarten in American Education*, Ch. II. Macmillan.

Miss Elizabeth Peabody of Boston is credited with establishing the first kindergartens in this country for English-speaking children. This was in 1860. She was inspired by some of the German immigrants, particularly by Mrs. Carl Schurz. In 1867 she studied Froebelianism under Baroness Bertha von Marenholtz-Bülow in England. Later she induced the Baroness to come to Boston.

In 1873 Miss Susan E. Blow, under the superintendence of Dr. W. T. Harris, introduced the kindergarten in the St. Louis public schools. She was an ardent advocate of following Froebel's use of materials very closely, arguing for strict adherence to his symbolism in materials. Her writings imply a very formal interpretation of Froebelian principles. She studied under Madame Kraus-Bolte, who had been a pupil of Froebel's widow. The latter had been very successful in England.[1, 2]

Dr. Harris, while a strong advocate of the kindergarten occupations, because of the belief that they would start the development of deftness which would be of industrial value later, did not feel that the use of materials should have place in the elementary grades. He argued for the "manual training school" for those taking up a trade.

The beginnings of manual training.[3] In the meantime another agency was working to bring the use of materials into educational practice. At the Centennial Exposition in 1876 at Philadephia, there was an exhibit of the Russian system of manual training which attracted much attention.

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[1] Parker, *op. cit.* (p. 466), pp. 456 457.

[2] Vandewalker, *op cit* (p. 466), Index

[3] Woodward, C. M. — *The Manual Training School*, pp. 1–15. Heath.

Prof. J. D. Runkle of the Massachusetts Institute of Tecl nology became particularly interested. He embodied a dis cussion of the exhibit in his report of 1876, recommendin that the courses in mechanical engineering be complete by adding instruction shops.

The Russian method of manual training had been intro duced into the Russian Imperial Technical School of Moscov in 1868 by Victor Della-Vos. This was a school of engi neering. Its distinctive emphasis in manual training wa upon its clear-cut, definite method of tool instruction wit the stress placed upon the technique. The method pro vided that each piece be reasonably perfect or be rejecte and a new one required. "The great value of the work of Della-Vos lay in the discovery of the true method of tool instruction, for without his discovery the later steps would have been impossible." [1,2]

The inspiration of this method of education is traceable to the influence of Otto Cygnaeus, of Finland, who in turn got his ideas from one of Froebel's fundamental factors in education, the use of motor expression, and from the writings of Pestalozzi. In 1858 Cygnaeus outlined a scheme of handwork for the primary schools of Finland. By 1866 some form of manual work was required of boys in all primary schools and in the male training colleges for teachers in that country.[3]

Prof. Runkle, who succeeded in establishing his shops in 1877, went farther than Della-Vos, for he soon became convinced that this shop instruction, which he believed was so necessary to an engineer's training, had also general educational values. His success in the work in manual training

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[1] Woodward, *op cit.* (p. 467), p. 2.

[2] Clark, I. A.--*Art and Industry*, Vol. III: 776-781. Government Printing Office, Washington, D. C.

[3] Parker, *op. cit.* (p. 466), p. 463.

was paralleled in time by the beginning of the St. Louis Manual Training School in 1879. The following statement from the circular issued in 1880 indicates the point of view in the school:

"The Manual Training School is not a mere workshop; the head is to be trained even more than the hand. Specific trades will not be taught; the tool-education will be liberal, extending impartially through all the shops.

"It is not expected that every boy who attends the school will become a mechanic, but we have reason to believe that a boy's experience in the school will clearly indicate whether he is fit to become a mechanic or not."[1]

This beginning at St. Louis was a private institution but soon the work was placed in the public high schools. Montclair, N. J., 1882; Jamestown, N. Y., 1882; Baltimore, Md., 1884; Washington, D. C., 1886; and Oakland, Calif., Springfield, Mass., Concord, N. H., Orange, N. J., and New York City in 1888 are credited with being among the very first cities to put manual training courses into the public high schools. By the end of 1890 there were thirty-eight cities which had begun this work in their high schools.[2]

The Swedish sloyd influence.[3] In the sixties and seventies, the Swedish sloyd movement began. At first the movement was economic, not educative. It began as a system of home industries to meet economic needs. These "hus," or house, occupations included carpentry, turning, wood carving, brush making, bookbinding, and cooper's and wheelwright's work. Instruction in these home occupations soon was put in the schools to insure its success. In 1872 the Swedish government decided that schools for instruction in sloyd were necessary to restore the waning physical and moral health of the people. This condition had arisen as a result of the concentration in cities coming from the factory system. Beginning as a system of "hus" sloyd, soon it became a system of well-organized tool work for boys of from twelve to fifteen. The things made were usually domestic utensils. Some schools were privately established. The one which became most widely known was established by Herr Abrahamson in 1872 at Nääs in connection with carrying on his estate. Two years later he started a similar school for girls, placing it in charge of his nephew, Otto Salomon. Seven of the ten hours of school were given to such handwork as wood sloyd, turnery, wood carving, and saddlery for boys; and weaving, spinning, knitting, sewing, and cookery for girls.

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[1] Woodward, *op cit.* (p. 467), p. 6.

[2] Parker, *op. cu.* (p. 466), p. 469.

[3] Salomon, Otto — *Theory of Educational Sloyd,* pp. vii *et seq.* Silver, Burdett.

In 1874 Abrahamson and Salomon opened a department to train teachers of sloyd, so popular had the work become. In 1877 Salomon visited Cygnaeus in Finland. The visit caused him to become convinced that this use of materials was a means of what he called formative education, the development of the child's " faculties," rather than a means of technical education. He believed it reached beyond the objective of the Finnish home industries. A little later, in 1882, he decided to use wood exclusively as the material for this formal educational system which he developed. His differed from the Russian system in that, instead of laying his emphasis upon the mastery of technique of processes as learned in practice upon making joints, for example, he put the emphasis upon the making of useful articles.

In his *Theory of Educational Sloyd* we find a most detailed description of the series of fifty models ultimately developed as a definite course in sloyd. Each model is detailed, not only as to dimensions, kind of wood, and tool processes involved, but for each the educational values are clearly, definitely stated, such as training in skill, dexterity, neatness, attention, accuracy, æsthetic sense, patience, honesty, perseverance, and love of labor. These are listed in various combinations through the entire system of fifty models. Muscular development is not listed as a value until the ninth model, a round ruler. Training in love of labor is not given until the eighth model, a packthread winder. "Promoting acquaintance with different kinds of wood" is given first in the thirty-fourth model, an American ax-handle from oak, although eight different kinds of wood are listed in the preceding thirty-three models. When one finds the making of a scoop, or a shuttle, or a cloak suspender, or a ladle listed because of the educational value found in training the æsthetic sense, he begins to feel that the insistence upon "formative" values was somewhat strained. In the sequence of technical processes, the series of fifty models is most carefully thought out. In the detailed directions as to dimensions, kind of wood, and tool processes involved, we find a masterly piece of analytical organization. Salomon based his claims for the work upon its contribution to the training of the "faculties." Much that is given in this book is so convincing that, in spite of the objections seen, one is forced to believe that there is something of value in the work outlined.

The spread of manual training. That manual training was recognized as reputable work is seen by examining educational publications from 1890 to 1900 — a period of rapid progress in the development of educational theory in this country.

Dr. Nicholas Murray Butler wrote of this movement: "Froebel in his kindergarten reduced theory to practice and in the kindergarten all manual training as well as all rational education has its basis. But Froebel's work did not include the development of a scheme of manual training for older pupils. The next step was to recognize the unity of principles which underlay the kindergarten at one end of the educational scheme, and the manual training school at the other; it was observed that both recognized the activities and the expressive powers as well as the receptive and assimilative powers. It was seen that the kindergarten and the manual training school were evidences of one and the same movement, though appearing at different points on the line."[1, 2]

In an editorial in the Educational Review, he said: "Efficient schemes of manual training suitable for elementary schools will doubtless be evolved in time, if, indeed, they have not been evolved already; but the manual training high school, as attested by its magnificent results in preparing its students for every department of active life, by the affection and the admiration of those who have gone through its curriculum, and by the popular support it enjoys, may already be regarded as a permanent feature of the American educational system."[3]

The beginnings of drawing.[4,5] When one tries to trace drawing back to its beginnings, he finds that Aristotle advocated freehand drawing instruction, but it was not looked upon as important in education until modern times. It was advocated by Comenius, Locke, Rousseau, and

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[1] Jessup, W. A. — *The Social Factors Affecting Special Supervision in the Public Schools of the United States*, pp. 45 46. Bureau of Publications, Teachers College, Columbia University, New York City.

[2] Reports of New York University. *102d Annual Report*, pp. 17-29.

[3] Educational Review, Vol 4, p 310.

[4] Monroe, Paul — *Cyclopedia of Education*, Article on *Art*. Macmillan.

[5] Clark, *op. cit.* (p. 468), Vol. III.

Pestalozzi. The latter advocated three-dimensional representation in clay. Froebel went farther than his immediate predecessor in putting such work into teaching.

There was discussion of the introduction of drawing into the Prussian elementary school system as early as the first quarter of the nineteenth century. The English Parliament established a national school of design in 1837. Manufacturing institutions became interested in its teaching. Denmark, France, and Austria began teaching it. In 1851 the International Exhibition was held in London. The work in drawing attracted much attention. As a result, the South Kensington school was reorganized, including courses in training teachers of art for the elementary schools. The industrial interest in the teaching of drawing developed over the continent, likewise.

The beginnings of drawing were quite meager in this country. In 1812 it was introduced in one of the public schools of Boston. There is record of an English high school in Boston having a course in drawing in 1827. In 1853 a special teacher of the subject was assigned, while Philadelphia, in 1842, appointed Rembrandt Peale as supervisor of drawing in the public schools. In 1860 drawing was made a permissive subject throughout the state of Massachusetts, and about 1870 it was made mandatory. By 1871, the reports of superintendents of forty-five towns of Massachusetts referred to drawing. About this time Walter Smith, who had been trained in South Kensington, was brought over to be director of art for Massachusetts. One of the first things he did was to develop a plan for training teachers. This resulted in 1873 in the formation of the Boston Normal Art School for the training of teachers. The Centennial Exposition at Philadelphia greatly furthered the interest in drawing through the exhibits placed there. The early work was exceedingly formal, giving much motor drill and offering almost no opportunity for self-expression. It was based upon the argument of the disciplinary value of the work. Much of the material for exercises was based upon geometric figures.

Household arts.[1] Another result of the Philadelphia Exposition in 1876 was the interest awakened in the teaching of household arts. The movement began in our eastern cities, notably in Boston, New York, and Philadelphia. It was supported by private funds. This work began in Boston as early as 1874. In 1879 the beginnings resulted in the opening of the Boston Cooking School, which in 1903 was incorporated with Simmons College. The work was begun in the public schools of Boston in 1885.

The work in New York City began as church sewing classes. In 1880 the Kitchen Garden Association was organized. In 1884 this became the Industrial Education Association, which in turn, in 1887, became the College for the Training of Teachers, and in 1892 became Teachers College. This school was later affiliated with Columbia University. In 1911 the work in Teachers College was so arranged as to give individual organization to the School of Practical Arts as distinguished from the School of Education. In 1888 cookery and sewing were begun as regular subjects in the public schools of New York City.

The outstanding work among the private schools beginning in Philadelphia was the cooking school of Mrs. Rorer, which continued for twenty-five years. Cooking and sewing were introduced into the public schools of Philadelphia in 1885, while Drexel Institute was founded in 1891.

Another outcome of the private beginnings of domestic art instruction in New York was the establishment of Pratt Institute in 1887.

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[1] Monroe, *op. cit.* (p. 472), Article on *Household Art Education.*

Some beginnings in teaching sewing and cooking were made even earlier in the West. Iowa had some work in 1869; the Kansas Agricultural College taught sewing in 1873–1874; the University of Illinois, then Illinois Industrial Institute, announced a School of Domestic Science and Art in 1871–1872. The Boston Cooking School, Drexel Institute, Teachers College, Pratt Institute, and the Kansas State Agricultural College each began, at an early date in its history, the training of teachers.

Historically one cannot very clearly trace these beginnings to definite European influences. A little needlework seems to have been thought of in English schools as early as 1840, but until 1875 little was done. Then cookery also was begun.

We find the beginnings of household arts work in Norway in 1865; in Belgium in 1874; in Denmark between 1870 and 1880; in Russia in 1880; in Sweden in 1882; in Scotland in 1884; in Ireland in 1886; in Finland in 1889; and in Wales about 1890 — dates practically coincident with beginnings in this country.

The beginnings of the use of materials in the elementary grades. Those who found value in the use of materials in the kindergarten began introducing it in the primary grades. By some, the formal gifts of the kindergarten were modified into other formal attempts in the primary grades. In many schools the elaborate system of "sixteen-fold" with paper as the material was used. Others, believing in the value of handwork merely, introduced card-sewing, bead-stringing, paper-weaving, stick-laying, and the like, as busy work. Likewise manual training was pushed down from the high school, grade by grade, until we find it as low as the fifth grade in knife-whittling courses, just as formal in its processes as the high school course.

As an illustration of the kind of work that resulted in the elementary school from these influences, there follows the course used in Jamestown, New York, in 1888, the work of Supt. Samuel G. Love:

> *First Year* — Penmanship, drawing, gymnastics, block-building, straw-stringing, stringing beads, and learning colors, tablet-laying, and paper-folding.
>
> *Second Year* — Penmanship, drawing, gymnastics, stick-laying, picture cutting, scrapbooks, spool-work, paper-embroidery, and braiding.
>
> *Third Year* — Penmanship, drawing, gymnastics, perforated cardboard embroidery, slat-plaiting, mat-weaving.
>
> *Fourth Year* — Penmanship, drawing, gymnastics, slat-plaiting, advanced crocheting, chain-stitch, paper-folding.
>
> *Fifth Year* — Penmanship, drawing, gymnastics, sewing over and over, crocheting, paper-folding, and mounting.
>
> *Sixth Year* – Penmanship, drawing, gymnastics, hemming, peas-work, knitting, paper-flower making.
>
> *Seventh Year* — For boys — Use of hammer, saw and plane, chisel and auger. For girls — Plain sewing, running, gathering, stitching, overcasting, and hemming. For boys and girls — Penmanship, drawing, and gymnastics; to set up type, also to distribute it.
>
> *Eight Year* — For boys — Lessons in construction with tools. For girls — Lessons in crocheting and knitting. For boys and girls — Penmanship, drawing, and gymnastics; to set up type, correct proof, make up forms.
>
> *Ninth Year* — For boys — Lessons with tools, mitering, dovetailing, doweling, etc. For girls — Knitting, mending, patching, darning, etc. For boys and girls — Penmanship, drawing, and gymnastics; setting up type, printing, etc.[1]

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[1] Butler, N. M. — *The Arguments for Manual Training.* Appendix, pp. 403–405. E. L. Kellogg & Co.

Another clue to the kind of work which developed in the effort to push kindergarten materials and object teaching up and to push manual training down into the elementary schools is to be found in a book review by Dr. Thomas Balliet. The book under discussion is Caroline F. Cutler's *Primary Manual Training: Methods in Form Study, Clay, Paper, and Color Work*, published as the results of directing the work in Boston. Describing the contents of the book Dr. Balliet says:

> The course outlined is in every essential point identical with the course followed in form study and drawing in the best schools. It is therefore a very safe book for teachers to follow. . . . Taken as a whole, the book will be a very valuable aid to teachers, especially those in rural and village schools where there is no special teacher of drawing to help them in their work.
>
> The lessons begin with the type forms, the sphere, the cube, and the cylinder, giving directions for modeling them in clay, and for expressing the "facts" by means of paper-cutting, skeleton models, paper-folding, and drawing. . . .
>
> This is followed by the development of the square, the right-angled triangular, and the equilateral triangular, prisms. Then comes a series of lessons on paper-folding that deal with the facts of the forms thus far studied. The study of the ellipsoid, oblate spheroid, ovoid, the cone, and the pyramid, together with a few pages on construction work in cardboard, form the remaining part of the book.[1]

These two illustrations indicate the tendencies that developed in the early efforts to introduce practical activities into elementary schools. This formalism and mechanical organization indicate faith in a subtle transfer of training or influence upon character apart from any direct results in meeting specific life problems.

[1] Educational Review, Vol 4, p. 93.

Montclair, N. J., was the first city to put manual training in the grammar grades. This was in 1882.

> Thus by the end of 1890 there had been established in the city public school systems in the United States, manual training in high schools in 38 cities, manual training in grammar grades in 34 cities, manual training in primary grades in 16 cities, kindergartens in 34 cities.[1]

The Herbartian movement.[2] Some other influences were felt in the decade from 1890 to 1900. A group of young men had recently returned from study in Germany. These men included Charles McMurry, Charles De Garmo, Frank McMurry, C. C. Van Liew, Elmer E. Brown, Herman T. Lukens, Nicholas Murray Butler, Levi Seeley, Francis W. Parker, and James E. Russell. Some had studied under Rein at Jena, others under Ziller at Leipsig, and others at Berlin and Halle. Herbart had done a signal piece of work in attempting to formulate a psychology which would take account of the learning process. He denied the doctrine of formal discipline with its belief in some mystical transfer of training, and set up a psychology which attempted to account for the development of character through the agency of the material definitely presented to the child.

The questioning of the validity of the faculty psychology. This antagonism toward the doctrine of formal discipline became very definite in the last decade of the nineteenth century, partly through the Herbartians who were prominent in educational leadership. The outstanding attack upon the doctrine seems to begin with the article by B. A. Hinsdale in 1894, entitled, "The Dogma of Formal Discipline."[3] It was published in the National Education Association report for 1894 and in the Educational Review for the same year. From that time the discussion of this question is recurrent in educational magazines and books for a number of years, even down to the present.

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[1] Parker, *op. cit.* (p 466), p. 470.

[2] *The Herbartian Yearbooks.* Public School Publishing Co., Bloomington, Ill.

[3] Educational Review, Vol 8, pp. 128–142.

It was in this same decade that Thorndike began making his contributions to psychology, and gradually there has developed a psychology which seriously questions many of the claims of formal discipline.

It can readily be seen that these two agencies — the Herbartian movement and the new psychology — very definitely broke down the fundamental basis upon which the manual training people had built the argument for their work. Of course this breakdown was gradual. Indeed there are some even to-day who would teach manual training for its disciplinary values.

Inadequacies of manual training. Investigation of the courses proposed and taught in our schools leads one to note these prominent inadequacies in manual training:

Want of relationship of the work to life. The sequence of the models was in terms of tool processes.

Failure to provide for the individuality of the child. Each must conform to the system.

Lack of motivation. The work was all prescribed in a fixed course.

Placing the emphasis upon the product as the objective, rather than upon the growth of the child.

The culture epoch theory. Another tendency appeared between 1890 and 1900 to affect the kind of handwork found in our schools. It, too, is traceable to the Herbartian movement through the disciples of Ziller. Ziller advocated the recapitulation theory of the child's development. From this he argued for the use of the culture products of the various race stages as the agency of the child's education. He made the series of culture products, as represented by the material in history and literature, the core of the course of study. The work in the other subjects came only in relationship to this core. This was called the doctrine of *concentration*.

This culture epoch theory was brought to America by the Herbartians, notably by C. C. Van Liew. The Herbartian Yearbook for 1896 devotes much space to the discussion of the theory, as did subsequent educational publications for several years.

Dr. John Dewey, in the *Herbartian Yearbook* for 1896, raised some very fundamental questions relative to the application of the theory. He said: " I have endeavored to point out that accepting the correspondence theory in general, requires, in its educational interpretation and bearings, first to be investigated, verified, and controlled absolutely from the side of child-life; and secondly, to be utilized primarily from the side of the activities and ideas in society which now correspond to the dawning interest, and only secondarily from that of the historical product of these activities and ideas. Even if the last point is not admitted, I think it must be confessed that there is a gap in the existing argument, from the fact of the corresponding epochs, to the study of the *products* of the race epochs: and that this gap needs to be filled before the theory is relieved of ambiguity and confusion and stands justified."[1]

But he argued that primitive peoples should be used to furnish a basis of comparison in interpreting the present, for " existing society is both too complex and too close to the child to be studied. He finds no clue into its labyrinth of detail and can mount no eminence whence to get a perspective of arrangement. The child . . . may be led to see man face to face with nature, without inherited capital, without tools, without manufactured materials. And, step by step, he may follow the processes by which man recognized the needs of his situation, thought out the weapons and instruments that enable him to cope with them and may learn how these new resources opened new horizons of growth and created new problems."[1]

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[1] *The Herbartian Yearbook, op. cit.* (p. 478), Vol. 2, p. 95.

The evolutionary basis of handwork. Now this theory, in some modification, manifested itself in the use of handwork in many elementary schools. Miss Katharine Dopp, of the University of Chicago, who worked for some time with Prof. Dewey, prepared the Industrial and Social Series, books of which have been referred to in foregoing chapters.

The plan of the books includes many suggestions relative to things to do. These, taken as a whole, constitute a rather complete reliving of the race experience in devising the beginnings of industrial processes.

There has been great divergence of opinion as to the validity of the underlying theories. This divergence of opinion can be seen by referring to the Proceedings of the Eastern Art and Manual Training Association for 1905 and 1906. In the first of these the evolutionary theory was presented, advocating the approach to an understanding of the present civilization through the study of primitive cultures, showing how the present has evolved from the past. The next year this point of view was opposed by those who advocated studying the industrial processes involved in the things of the child's environment *only*, rather than studying a thing because it comes next in the evolutionary sequence of race development. This latter theory is called by some the *neighborhood* approach to the use of materials.

The diverging theories summarized. Beginning with 1860, we find a variety in points of view relative to the use of materials in teaching in the elementary school. With the manual training men advocating handwork for its disciplinary value; the Oswego teachers advocating a formal use of materials in object teaching; the kindergartners advocating play materials, usually of a very formal type; the drawing teachers giving many formal drill exercises based upon geometric designs; the household arts teachers requiring samplers of stitches, and seams, and buttonholes; the recapitulation theorists demanding the reinvention of the fundamental race industrial processes; the "neighborhood" adherents demanding an investigation of only the processes and products of industry in the child's immediate environment; the untrained teachers eagerly seizing upon any device that pleases the children and keeps them busy; the less scientific group of teachers believing in some mythical potency involved in handwork; and the new psychologists questioning the disciplinary psychology and advocating specific training for specific situations — with all these opposing and divergent tendencies and objectives, we naturally may expect to find a chaotic situation in the use of handwork in our schools.

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[1] Dewey, John — *School and Society*, pp. 155, 157. University of Chicago Press

The industrial-social study involving the use of materials. Dean James E. Russell, in the Educational Review for December, 1909, discussed the confused situation, summarizing the chaotic state by saying, "Woolly sheep have sported with polar bears under fir trees set in a desert of sand. Bookbinding and block houses, Indian war bonnets and water wheels, inkwells and Navajo blankets, bent iron gimcracks and raffia baskets, bookshelves and doll clothes, broom holders and picture frames — all these and a thousand more mixed up in indescribable confusion!"[1]

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[1] Russell, J. E. and Bonser, F. G. — *Industrial Education*, p. 4. Bureau of Publications, Teachers College, Columbia University, New York City.

He proposed as an organizing principle a course based on the industrial-social objective — the study of the work man does in taking materials furnished by nature and making them into more usable products. He proposed that industrial arts should be a subject of study dealing with the fundamental industrial processes used by the race. Such a course should include whatever is valuable in the courses now offered in the elementary schools under the terms drawing, manual training, cooking, and sewing; with such additional material as will be required to satisfy general needs.

In 1910 a definite beginning was made to formulate a course under this plan at Teachers College, using Speyer School as a laboratory for testing out the proposed work. The results of this work were embodied in the subject called industrial arts. The first published course of study on this new basis of organization was included in the *Speyer School Curriculum*, issued in 1913. From this beginning have developed the principles and practice presented in this book.

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